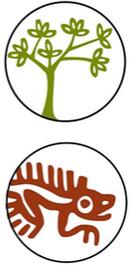


Targeted Fauna Assessment (Biota 2020)



Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment



Prepared for BORR IPT

June 2020

Biota
Environmental
Sciences



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BORR Southern Section Fauna Assessment

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1.0 Executive Summary

1.1 Introduction

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Bunbury Outer Ring Road (BORR) project. The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway, and will provide a high standard route for access to the Bunbury Port and improve road user safety. The completed BORR will also provide an effective bypass of Bunbury for inter-regional traffic and freight, reducing traffic on the local road network, and facilitate proposed development to the east of the city of Bunbury. BORR forms a major component of the planned regional road network for the Greater Bunbury area.

This document pertains to the Proposal Area in relation to the BORR Southern Section and has been prepared to address the EPA's 21 October 2019 request for additional information to support an Assessment on Referral Information, specifically including updated assessment of impacts to threatened fauna informed by the results of additional targeted surveys.

Biota Environmental Sciences (Biota) was commissioned to undertake a desktop review and targeted field survey in relation to the following conservation significant species:

- Carnaby's Black-Cockatoo (*Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Endangered);
- Baudin's Black-Cockatoo (BC Act and EPBC Act Endangered);
- Forest Red-tailed Black-Cockatoo (BC Act and EPBC Act Vulnerable); and
- Western Ringtail Possum (BC Act and EPBC Act Critically Endangered).

Furthermore, the likelihood of occurrence was to be assessed for the following conservation significant species:

- Wambenger Brush-tailed Phascogale (hereafter the Brush-tailed Phascogale) (BC Act Conservation Dependent Fauna); and
- Chuditch (BC Act and EPBC Act Vulnerable).

1.2 Methods

Spotlighting for Western Ringtail Possums was completed over the large majority of the suitable habitat within the Proposal Area using a strip-sampling technique, which aimed to record all individuals. Strips of 20 m width were pre-loaded onto map imagery and displayed on tablets with a GPS accuracy typically to within 1.5 m. A zoologist searched each 20 m wide strip for the Western Ringtail Possum at night using a high-powered head torch. Strip-sampling was conducted on four occasions; mid-August 2019, mid-October 2019, early-December 2019 and early-February 2020. The same method was also applied to a reference site, Shire of Capel Reserve 23000 (henceforth the 'Reference Site'), 146.1 ha in size and located directly adjacent west the southern end of Proposal Area. Strip-sampling at the Reference Site was conducted on three occasions; early-November 2019, early-December 2019 and early-February 2020.

This spotlight strip-sampling method was also applicable to the Brush-tailed Phascogale and Chuditch, and effectively all surveys for the Western Ringtail Possum were considered to represent sampling effort for these species also.

Habitat for black-cockatoos was assessed by foot-traversing the Proposal Area. In larger vegetation fragments, a systematic approach was applied, whereby transects of 25 m spacing were overlain on the survey area in GIS. A zoologist then walked down the middle of the two 25 m transects, effectively using them as the boundary to search a 25 m wide strip, and recorded habitat trees. This was continued until the entire fragment had been searched. In small fragments or where there were singular trees, transects were discarded in favour of walking

between individual trees. For any tree supporting hollow/s, details of the hollows were taken, and a differential or high accuracy GPS was used to record the tree location. Those trees with hollows potentially suitable for breeding were subject to a follow-up hollow assessment, which included the use of a remotely piloted aircraft (RPA) to obtain images of the hollows.

1.3 Results

1.3.1 Fauna Habitats

The 199.73 ha Proposal Area includes 124.34 ha of land historically cleared for agriculture, road infrastructure and housing, leaving approximately 75.39 ha vegetated. As far as practicable, all vegetation within the Proposal Area, was ground-truthed. Drawing on field observations, together with the vegetation mapping of the Proposal Area, the following broad habitats were described (from most common to least):

- *Mari/Eucalyptus* woodland (43.71 ha);
- *Mari/Eucalyptus* in paddocks and road reserves (21.66 ha); and
- *Melaleuca* shrubland and/or woodland (10.02 ha).

1.3.2 Target Species

1.3.2.1 Western Ringtail Possum

The abundance of Western Ringtail Possums recorded each phase of strip-sampling was as follows: 53 in August 2019, 76 in October 2019, 79 in December 2019 and 67 in February 2020.

The average density of Western Ringtail Possums in the 75.39 ha of surveyed habitat was 0.91 individuals per hectare. Given that this survey included the large majority of habitat available, we may also present this as a Proposal Area density of 0.34 individuals per hectare (199.73 ha). Highest densities were recorded in the *Mari/Eucalyptus* Woodland habitat with an average of 1.12 individuals per hectare surveyed, followed by *Mari/Eucalyptus* in Paddocks and Road Reserves at 0.87 individuals per hectare while the *Melaleuca* Shrubland and/or Woodland habitat supported a considerably lower density at 0.075 individuals per hectare.

The abundance of Western Ringtail Possum recorded at the Reference Site was 165 in November 2019, 175 in December 2019 and 136 in February 2020 for an average of 158.67. With a surveyed area of 146.1 ha, the Reference Site supported an average density of 1.09 individuals per hectare.

1.3.2.2 Black-cockatoos

Black-cockatoo breeding habitat trees were considered to be those of relevant species with a diameter at breast height (DBH) of 50 cm or greater as defined in Commonwealth Referral guidelines (DSEWPac 2012a). A total of 1,109 trees of a suitable DBH were recorded within the Proposal Area. A total of 115 trees were included in a dedicated tree hollow assessment, which incorporated the use of a Remotely Piloted Aircraft (RPA). Of the 115 trees, five were found to support hollows that were classified as potentially suitable for black-cockatoo nesting, 26 were classified as unlikely suitable, 76 were classified as not suitable while eight trees received ground assessment only as their hollows could not be accessed with the RPA. No conclusive evidence of nesting, such as black-cockatoos in attendance at hollows, has been observed within the Proposal Area. Indeterminate evidence has been recorded on a small number of occasions including a potentially suitable hollow with chew marks and a hollow containing 3+ large eggs (black-cockatoos more commonly have two-egg clutches), furthermore, a broken egg shell consistent with Forest Red-tailed Black-Cockatoo was found on the ground in 2017.

Feeding evidence of all three black-cockatoo species was identified within the Proposal Area and the 43.71 ha of *Mari/Eucalyptus* woodland habitat was classified as high quality foraging habitat and a further 21.66 ha *Mari/Eucalyptus* in paddocks and road reserves was classified as moderate quality foraging habitat. The remainder of the Proposal Area was largely devoid of

foraging plants being either cleared, highly modified or otherwise supporting vegetation types not suitable for foraging such as *Melaleuca* in dampland areas.

1.3.2.3 Brush-tailed Phascogale

Four Brush-tailed Phascogales were recorded within the Proposal Area during the recent strip-sampling phases while a further five were recorded in adjacent areas. Twenty-two individuals were recorded in the Reference Site.

1.3.2.4 Chuditch

No Chuditch were recorded within the Proposal Area despite intensive spotlighting effort in the area over the past two years. Based on recent regional records and availability of habitat, the species was assessed as a possible transient occurrence in the Proposal Area and would not be resident.

1.3.3 Non-target Conservation Significant Species

In addition to the target conservation significant species, the following seven species have either been recorded within the Proposal Area, or are considered to have some potential to occur within the Proposal Area based on habitat availability and previous records in the local area:

- Southern Brown Bandicoot, Quenda (Priority 4) – Occurs (recorded);
- Black-striped Dwarf Galaxias, Black-stripe Minnow (Endangered) – Occurs;
- Peregrine Falcon (Other specially protected fauna) – Likely to occur (visitor);
- Water Rat (Priority 4) – Likely to occur;
- Coastal Plains Skink (Priority 3) – Possible;
- Western Brush Wallaby (Priority 4) – Possible;
- Western False Pipistrelle (Priority 4) – Possible; and
- Blue-billed Duck (Priority 4) – Possible (visitor).

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2.0 Introduction

2.1 Proposal

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Bunbury Outer Ring Road (BORR) project. The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway and will provide a high standard route for access to the Bunbury Port and improve road user safety. The completed BORR will also provide an effective bypass of Bunbury for inter-regional traffic and freight, reducing traffic on the local road network, and facilitate proposed development to the east of the city of Bunbury. BORR forms a major component of the planned regional road network for the Greater Bunbury area.

The BORR forms a major component of the planned regional road network for the Greater Bunbury area. The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road;
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway (south) (an existing 4 km section which was completed in May 2013), along with a 3 km extension of Willinge Drive southwards to South Western Highway; and
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This report details the methods and results of a desktop assessment and targeted field survey over the BORR Southern Section Proposal Area (referred to as the 'Proposal Area' hereafter) (Figure 2.1). It has been prepared to address the EPA's 21 October 2019 request for additional information to support an Assessment on Referral Information, specifically including updated assessment of impacts to threatened fauna informed by the results of additional targeted surveys.

2.2 Study Objectives and Scope

In order to inform the environmental impact assessment of the BORR project, Biota Environmental Sciences (Biota) was commissioned to undertake the following:

- conduct a desktop review of relevant previous fauna survey work;
- assess black-cockatoo foraging habitat, and roosting, potential breeding and actual breeding trees as per Commonwealth guidelines;
- estimate abundance of the Western Ringtail Possum;
- assess the likelihood of occurrence of the Brush-tailed Phascogale and Chuditch; and
- identify and map fauna habitats.

Results from within the Proposal Area were considered within a framework of recent contextual work in relation to the Western Ringtail Possum, which included intensive strip-sampling at a local reference site as well as distance sampling at an additional four sites within 5 km of the Proposal Area.

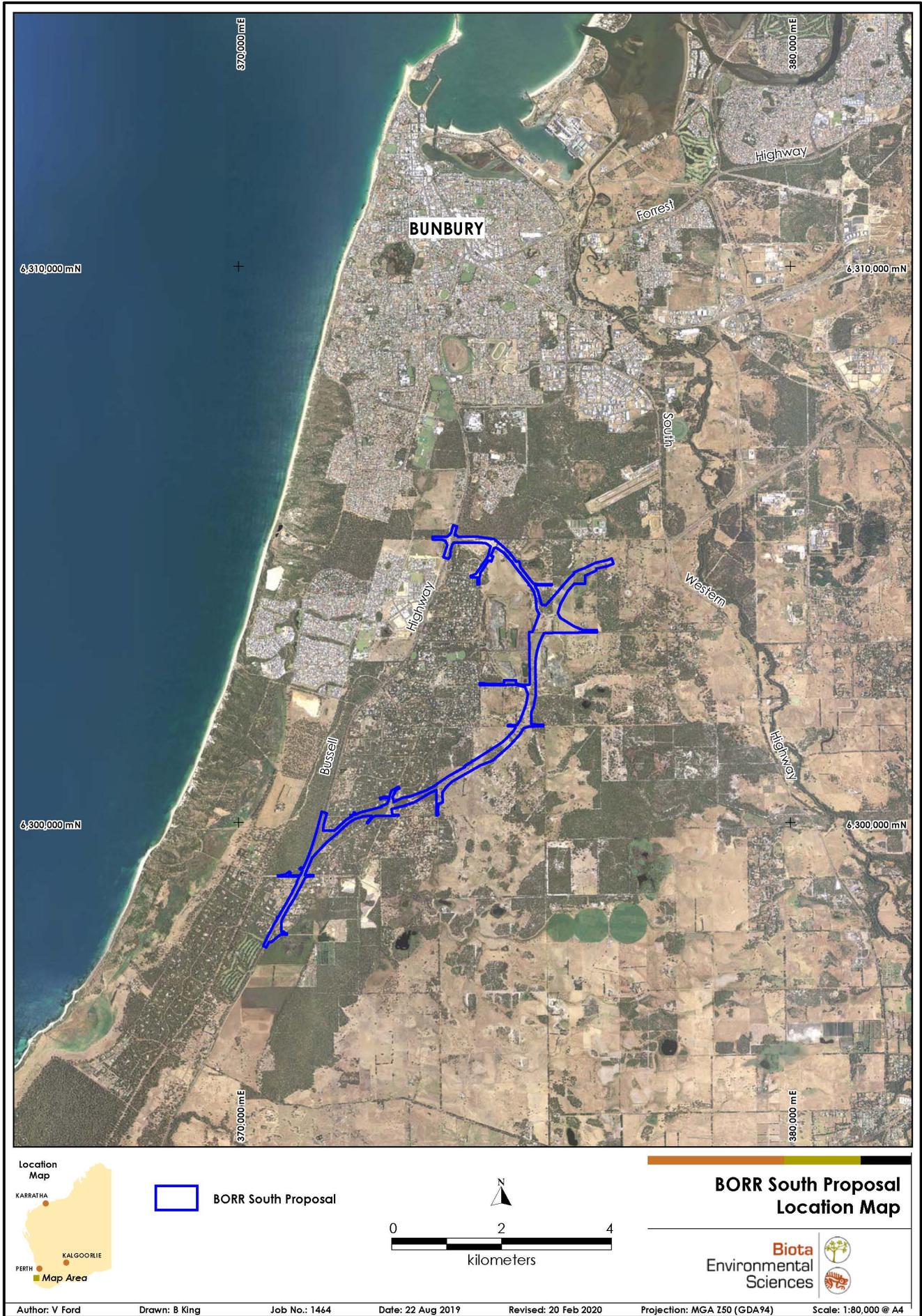


Figure 2.1: Location of the BORR Southern Section Proposal Area.

3.0 Methods

3.1 Desktop Review

A literature review was carried out to ascertain previous sampling effort in the local area (within 10 km); in particular, records of the target species (Western Ringtail Possum, black-cockatoos, Chuditch and Brush-tailed Phascogale), but also other conservation significant fauna.

The following sources of information were reviewed to compile a species inventory for the Proposal Area:

1. NatureMap database (<http://NatureMap.dec.wa.gov.au>): a joint project of the Department of Biodiversity Conservation and Attractions (DBCA) and the Western Australian Museum (WAM). This database represents the most comprehensive source of information on the distribution of Western Australia's fauna, comprising records from the Fauna Survey Returns database and WA Threatened Fauna Database (both managed by the DBCA), the WAM Specimen database and the Birdlife Australia Birddata database. The database search was completed on 29 October 2018 using a 10 km buffer on a central line described by the coordinates:
 - 33°23'14"S 115°39'49"E;
 - 33°24'50"S 115°39'06"E;
 - 33°26'06"S 115°37'06"E;
 - 33°27'24"S 115°36'11"E.

The raw data returned are included as Appendix 4.

2. The Commonwealth EPBC Act Protected Matters Search Tool database. The database was searched using the same coordinates as the NatureMap search above, on the 29 October 2018. The raw data returned are included as Appendix 5.
3. Biota's internal database. Biota has conducted a number of recent studies associated with the BORR proposal; our database of records was utilised particularly in the context of Western Ringtail Possums. These studies are detailed in Table 3.2; and
4. Studies by other authors, as detailed in Table 3.2.

3.2 Conservation Significant Species Likelihood

Following field survey conservation significant species returned from the desktop review were assigned to one of four categories, ranging from 'Occurs' to 'Unlikely to occur' using the criteria defined in Table 3.1. The number of historical records, and their timing and distance from the Proposal Area were considered in the likelihood assessment. Some species returned during the desktop review were confidently assessed as 'Unlikely to occur' due to an absence of specific habitat requirements within the Proposal Area, or a well-defined distribution that does not include the Proposal Area.

Table 3.1: Categories of likelihood assigned to conservation significant species in desktop search.

Status	Description
Occurs	Recorded in current survey through direct sighting or secondary evidence such as nut chews or diggings.
Likely to occur	Recent records (past 5 years) within Proposal Area and nearest record <1 km from Proposal Area boundary.
Possible	Nearest record <5 km from Proposal Area boundary, and suitable habitat present. Lack of records may be due to low survey effort/cryptic behaviour of species or rarity. The study area lacks core habitat, however, it may occur as a visitor to forage or on route between areas of core habitat.
Unlikely to occur	Few records overall in past 10 years, or no records at all. Nearest record >5 km from Proposal Area boundary. Habitat unsuitable or degraded/fragmented.

Table 3.2: Previous studies reviewed in relation to the Proposal Area.

Report / Survey	Survey Dates (effort)	Survey Description	Records	Proximity to Proposal Area
Lot 1 Wallrodt Road, Picton Environmental Values Assessment (GHD 2010a).	October 2010 (1 day)	Site inspection searching for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	3 km.
Lot 15 Bunbury Outer Ring Road (Stage 2) Environmental Values Assessment (GHD 2010b).	October 2010 (1 day)	Site inspection searching for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	2.5 km.
Western Ringtail Possum Survey & Black Cockatoo Habitat Assessment of Sabina Vale Loc 3819 (Harewood 2013).	(i) 26 March 2013 (ii) 2 April 2013 (1 day, 1 night)	Targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possum (scats, dreys, sightings). Nocturnal survey for Western Ringtail Possums.	1 Western Ringtail Possum, 195 black-cockatoo habitat trees (13 with hollows).	30 km.
Bunbury Outer Ring Road Southern Section, South Western to Bussell Highways (GHD 2012).	21 – 23 September 2011 (3 days)	Targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possum (scats, dreys, sightings).	565 black-cockatoo habitat trees, secondary evidence of Western Ringtail Possum (<3 sightings).	Overlapping Proposal Area.
Main Roads Lot 1 Ducane Road Environmental Values Assessment (GHD 2014).	12 – 13 June 2013 (2 days, 1 night)	Level 1 and targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possums (scats, dreys, sightings). Nocturnal survey for Western Ringtail Possums.	38 black-cockatoo habitat trees, 1 Western Ringtail Possum recorded during night survey.	Overlapping Proposal Area.
Shire of Dardanup Waterloo Urban and Industrial Expansion Flora and Fauna Survey (GHD 2015).	(i) 13 – 14 August 2014 (ii) 29 – 31 October 2014 (5 days)	Black cockatoo and Western Ringtail Possum habitat assessment. Evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	6 km.
Bunbury Port Access Road Project Stage 2 Rare Fauna Survey (GHD 2010c).	(i) 17 February – 5 March 2009 (ii) 4 – 7 August 2009 (8 days, 5 nights)	Level 1 fauna survey.	3 Western Ringtail Possums, black-cockatoo confirmed.	Partially overlapping.
Bunbury Outer Ring Road (Southern Section) Black Cockatoo Tree Survey (Biota 2018a).	13 – 15 November 2017 (3 days)	Cockatoo habitat tree assessment.	649 black-cockatoo breeding habitat trees (139 with hollows).	Largely within Proposal Area.
Bunbury Outer Ring Road, Southern Section Western Ringtail Possum Assessment (Biota 2018b).	25 February – 5 March 2018 (8 nights) 22 -30 August (8 nights)	Targeted distance sampling survey for Western Ringtail Possum within the BORR Proposal Area and contextual sites (Reserve 23000, Lot 1 and Lot 2).	Feb/March: 172 Western Ringtail Possums, Aug: 148 Western Ringtail Possums	Some overlap within Proposal Area.
Phase 1 Survey for the Western Ringtail Possum in the BORR, Lot 1 Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities (Biota 2018c).	10 – 13 July 2018 (3 nights)	Targeted survey for Western Ringtail Possums	73 Western Ringtail Possums.	Some sites overlapping and otherwise all within 5 km.

Report / Survey	Survey Dates (effort)	Survey Description	Records	Proximity to Proposal Area
Phase 2 Survey for the Western Ringtail Possum in the BORR, Lot 1 Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities, Centenary Road, Golf Drive, Picton East (Biota 2018d).	22 August 2018 – 4 September 2018 (12 nights)	Targeted survey for Western Ringtail Possums	114 Western Ringtail Possums.	Some sites overlapping and otherwise all within 5 km.
Phase 3 Survey for the Western Ringtail Possum in the BORR: Southern Lots and Manea Park (Biota in prep.).	30 October – 5 November 2018 (6 nights)	Targeted survey for Western Ringtail Possums	143 Western Ringtail Possums.	Southern Lots are located within 1–6 km of the Proposal Area and Manea Park is adjacent to the northern edge of the Proposal Area.
Targeted Fauna Survey: Lots 267, 268 and 153 Ducane Road, Gelorup (Biota 2019)	20 – 23 June 2019 01- 04 July 2019	Black-cockatoo habitat assessment and Western Ringtail Possum Survey.	1,243 black-cockatoo habitat trees, 133 hollows, secondary foraging evidence. 41 Western Ringtail Possums.	2 km.
Targeted Fauna Survey: Lot 269 Ducane Rd Gelorup (Biota 2019)	9 – 10 September 2019	Black-cockatoo habitat assessment and Western Ringtail Possum Survey.	85 black-cockatoo habitat trees, 41 hollows. 24 Western Ringtail Possums	2 km.

3.3 Legislation and Policy Conformance

All surveys were completed as far as practicable in accordance with relevant State and Commonwealth policy, and to a standard that would provide adequate information to assess the Proposal against principles and environmental aims relating to the environmental factor 'Terrestrial Fauna' (EPA 2016a). Table 3.3 provides a summary of the most important and relevant legislation, policy and guidelines relating to this study.

Table 3.3: State and Commonwealth legislation, policy and guidelines of most relevance to this study.

Legislation, Guideline or Policy	Application to this Study	Agency
Commonwealth		
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (the EPBC Act).	Legislates species considered to be of national environmental significance.	Department of Agriculture, Water and the Environment
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013).	Defines matters of national environmental significance and what constitutes a significant impact.	Department of Agriculture, Water and the Environment
Significant impact guidelines for the vulnerable western ringtail possum (<i>Pseudocheirus occidentalis</i>) in the southern Swan Coastal Plain, Western Australia (DEWHA 2009)	Details ecology including habitat requirements.	Department of Agriculture, Water and the Environment
EPBC Act referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>), Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) and the Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) (DSEWPoC 2012)	Details distribution, ecology and recommended survey methodology.	Department of Agriculture, Water and the Environment
Western Australia		
<i>Biodiversity Conservation Act 2016</i> (BC Act) and Biodiversity Conservation Regulations 2018	Western Australia's biodiversity protection legislation. Replaces the <i>Wildlife Conservation Act 1950</i> . Provides for species, subspecies or populations of native animals (fauna) to be listed as Specially Protected, Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia.	Department of Biodiversity, Conservation and Attractions
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016a).	Overall aim of the study is to provide adequate information to assess the Proposal against the EPA's objective for the environmental factor Terrestrial Fauna; stated to be "To protect terrestrial fauna so that biological diversity and ecological integrity are maintained".	Environmental Protection Authority
Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>) Recovery Plan. Wildlife Management Program No. 58 (DPaW 2017a)	Details ecology of the species and priority survey objectives.	Department of Biodiversity, Conservation and Attractions

3.4 Nomenclature

Consistent with the EPA (2016b) nomenclature for amphibians, reptiles and mammals follows the standards of the WA Museum fauna taxonomic checklist, which is revised and released every six months or as necessary while avifauna nomenclature is in accordance with Christidis and Boles (2008).

3.5 Timing, Team and Permits

The field survey was conducted in several phases commencing in September 2018 and continuing through to February 2020, as detailed in Table 3.4. The extended nature of the survey work reflects early contextual work over an indicative survey area with follow-up resurvey work focusing on the Proposal Area once finalised.

In relation to the timing of typical black-cockatoo presence on the Swan Coastal Plain, Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo are most commonly found as foraging visitors from February through to September while the timing of Forest Red-tailed Black-Cockatoo presence is more flexible. While not a typical breeding stronghold area for any of the three black-cockatoo species, the Bunbury area is listed as a known breeding area for both Carnaby's Black-Cockatoo and Baudin's Black-Cockatoo as well as being within the known breeding range for Forest Red-tailed Black-Cockatoo. The timing of breeding in Carnaby's and Baudin's Black-Cockatoos is generally from August to December while timing is more flexible in Forest Red-tailed Black-Cockatoo with some indications that breeding on the Swan Coastal Plain in this species peaks in November/December. The timing of surveys in October to December were therefore well placed to detect any potential breeding. The timing of the surveys allowed less opportunity to record foraging individuals but foraging evidence persists in the landscape.

Table 3.4: Summary of survey timing and weather conditions.¹

Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
1/10/18	Black cockatoo habitat assessment, Nocturnal searches	Victoria Ford, Michael Greenham, Joshua Keen, Brandon King	11.3	20.9	0
2/10/18			9.6	21.8	0
3/10/18			10.2	21	0
4/10/18			12.4	22.7	4.4
5/10/18			15.1	20.9	0.2
6/10/18			12.7	21.2	0.6
Avg./Total			11.9	21.4	5.2
30/10/18	Black cockatoo habitat assessment,	Victoria Ford, Joshua Keen, Brandon King	10.7	23.1	0
31/10/18			9.8	22.6	0
1/11/18			7.7	19.4	0
2/11/18			12.1	19.8	0
3/11/18			11.5	22.4	0.2
4/11/18			7.9	20	0
5/11/18			10.6	18.2	0.6
Avg./Total			10.0	20.8	0.8
28/11/18	Remotely piloted aircraft survey of hollow-bearing trees	Joshua Keen, Shane Priddle	10.3	22.4	0
29/11/18			9.8	24.2	0
30/11/18			7.3	21.3	0
1/12/18			12.7	21.8	0
2/12/18			7.3	24.2	0
3/12/18			11.1	32.3	0
4/12/18			13.8	22.2	0
5/12/18			11.5	21.9	0
6/12/18			12.6	20.7	4.8
7/12/18			7.8	22.1	0
8/12/18			11.8	24.7	0
9/12/18			12.4	29.9	0
12/12/18			14.6	23.8	0
Avg./Total			10.7	24.1	4.8
29/01/19	Black cockatoo habitat and hollow assessment	Jacinta King, Joshua Keen	11.2	28.3	0
30/01/19	Black cockatoo habitat and hollow assessment	Jacinta King, Joshua Keen,	10.4	30.9	0
1/02/19	RPA assessment	Shane Priddle	17.7	35.0	0
Avg./Total			14.0	33.0	0

Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
17/08/19	Proposal Area WRP strip-sampling Phase 1	Joshua Keen, Pierre-Louis de Kock	7.3	15.7	18.8
18/08/19			2	17.4	0
19/08/19			3.1	18	0
20/08/19			3.3	19.6	0
Avg./Total			3.9	17.7	18.8
17/10/19	Proposal Area WRP strip-sampling Phase 2	Joshua Keen, John Graff	4.3	19.6	0
18/10/19			7.5	22.3	0
19/10/19			10.1	28.7	0
20/10/19			15.2	22.1	0
Avg./Total			9.2	23.2	0
8/11/19	Reference Site strip-sampling	Alexander Kabat, Peter Kendrick	10.6	29.4	0
9/11/19			16.5	37.5	0
11/11/19			12.8	26.7	0
12/11/19			11.6	27.8	0
15/11/19			13.7	34.6	0
Avg./Total			13.0	31.2	0
25/11/19	Habitat trees in unsurveyed gaps and drone resurvey of suitable hollows	Joshua Keen, Shane Priddle	12.1	26.1	0
26/11/19			10.9	26.8	0
Avg./Total			11.5	26.5	0
2/12/19	Proposal Area WRP strip-sampling Phase 3	Joshua Keen, John Graff	15.5	31.9	0
3/12/19			15.9	35.4	0
4/12/19			17.5	35.2	0
5/12/19			14.3	33.2	0
6/12/19			22.0	36.9	0
7/12/19			15.2	25.2	0
Avg./Total			16.7	33.0	0
6/12/19	Reference Site Strip-sampling	Nathan Beerkens, Stewart Ford, John Graff, Michael Greenham, Joshua Keen, Peter Kendrick, Roy Teale	22.0	36.9	0
7/12/19			15.2	25.2	0
9/12/19			11.0	25.2	0
10/12/19			15.7	32.9	0
Avg./Total			16.0	30.0	0
3/02/20	Proposal Area WRP strip-sampling Phase 4	Joshua Keen, Roy Teale	15.9	36	0
4/02/20			19.3	38.8	0
7/02/20			20	26.4	0
8/02/20			16.2	25.4	0
9/02/20			8.7	27.9	0
Avg./Total			16.0	30.9	0
8/02/20	Reference Site Strip-sampling	Nathan Beerkens, John Graff, Joshua Keen, Roy Teale	16.2	25.4	0
9/02/20			8.7	27.9	0
10/02/20			12.3	31.9	0
11/02/20			16.3	34.5	0
12/02/20			20.2	28.8	0
13/02/20			18.7	32.9	0.4
14/02/20			19.9	37.3	0
Avg./Total			16.04	31.24	0.4

1: Data from Bureau of Meteorology recording station Carey Park (Station No. 9965), near Bunbury.

Conditions in the year preceding the surveys were largely typical of long-term averages, although the 2018 winter immediately preceding the survey work was wetter than average (Figure 3.1). This would be expected to have had a positive effect on foliage productivity and food resources for the Western Ringtail Possum and black-cockatoo species. During the 2019 survey period, rainfall was unusually high in early winter (June) followed by considerably lower than average rainfall for the July, August and September 2019 months.

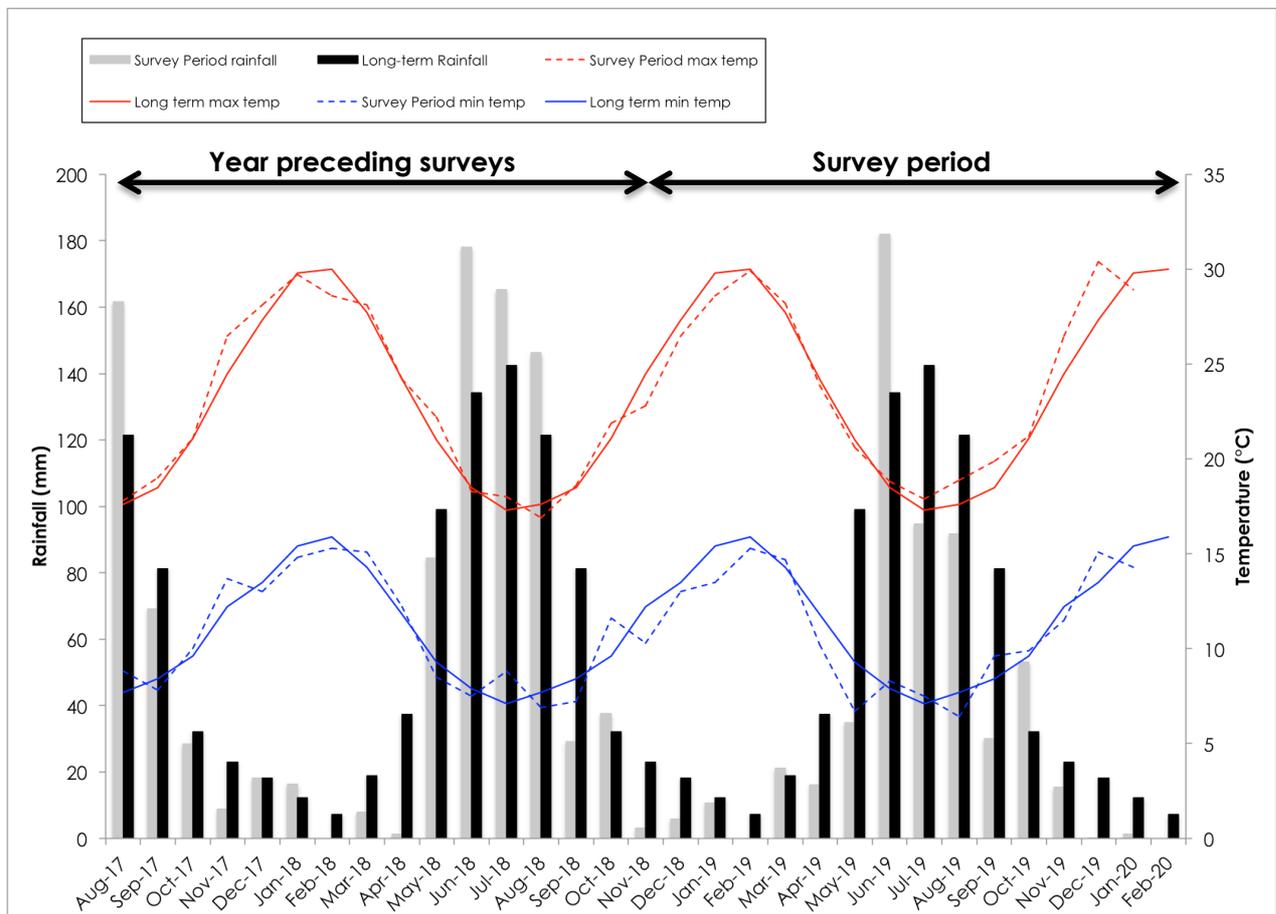


Figure 3.1: Average monthly weather conditions in the year preceding the field surveys, then throughout the survey period ad through to November, compared with long-term climatological averages (data from the Bureau of Meteorology station at Carey Park, 1995–2019).

With the exception of RPA pilot Shane Priddle (SW Environmental), all team members were Biota biologists. GIS mapping and calculations were undertaken by Paul Sawers and Brandon King of Biota.

The fauna survey was conducted under the following licenses issued by the DBCA (Appendix 2):

- Regulation 17 "Licence to Take Fauna for Scientific Purposes" Permit No. 08-002773-2
- Regulation 27 Fauna Taking (Biological Assessment) Licence number BA27000005-3

3.6 Western Ringtail Possum

A strip-sampling approach was applied to the entirety of potential Western Ringtail Possum habitat within the Proposal Area. This strip-sampling exercise was undertaken on four occasions (mid-August, mid-October and early December 2019, and early February 2020) to examine temporal and spatial variation in abundance throughout the Proposal Area. Transect coverage within the Proposal Area is shown in Figure 3.2. In some areas transects extended beyond the Proposal Area, reflecting an earlier indicative survey boundary that was in effect at the advent of the strip-sampling programme, prior to the refinement of the current Proposal Area. These additional areas have been retained in all phases of the strip-sampling programme. A total strip-sampling transect length of 49.04 km was applied to the 75.39 ha of predominantly native vegetation within the Proposal Area, however, as illustrated in Figure 3.2, some areas within the Proposal Area could not be surveyed on occasion at the request of the landholder. Access restrictions affected 8.19 ha of surveyable habitat in the first phase sampling (August 2019) and between 2.48 ha and 4.18 ha in the latter three phases.

In addition to the Proposal Area, a reference site, the Shire of Capel Reserve 23000 (hereafter the 'Reference Site') was introduced into the strip-sampling programme in November 2019 with follow up sampling phases in early December 2019 and early February 2020 conducted concurrently with the Proposal Area sampling. The Reference Site is 146.1 ha in size and was selected both

because of its proximity to the Proposal Area, being located adjacent west its southern end (Figure 3.2), and also because earlier contextual sampling in 2018 demonstrated that it supported a Western Ringtail Possum population (see Section 6.1.1). No access restrictions applied to the Reference Site, within which 157 transects, totalling 72.98 km, were sampled during all three phases.

Strips of 20 m-width were pre-loaded onto map imagery and displayed on tablets with high-accuracy GPS generally to within 1.5 m or less. The 20 m width of the strips was chosen based on modelling of distance data (Biota and Analytical Edge 2019a) accumulated from over three thousand detections of Western Ringtail Possums; this indicates a probability of detection of greater than 98% up to a distance of 10 m from a transect. It is therefore assumed that the number of Western Ringtail Possums counted when using this approach approximates the real abundance within the Proposal Area, although it is likely to represent a slight underestimate. A zoologist walked down each 20 m-wide strip spotlighting for the Western Ringtail Possum using a high-powered head torch. Surveys generally commenced half an hour after sunset and were completed by 2 am.

In open pasture with scattered trees, searching individual paddock trees was undertaken in favour of searches of strips. In addition to the Western Ringtail Possum, observations of the Common Brushtail Possum and Brush-tailed Phascogale were also recorded.

The following information was recorded with every Western Ringtail Possum observation:

- species;
- observer;
- animal location using GPS, taken while standing directly beneath;
- time;
- number of individuals;
- age class: subadult independent, adult, adult with young at heel, or female with young on back;
- cue: seen (eyeshine), seen (no eyeshine) or heard;
- drey or hollow at observation point; and
- dominant habitat at observation point.

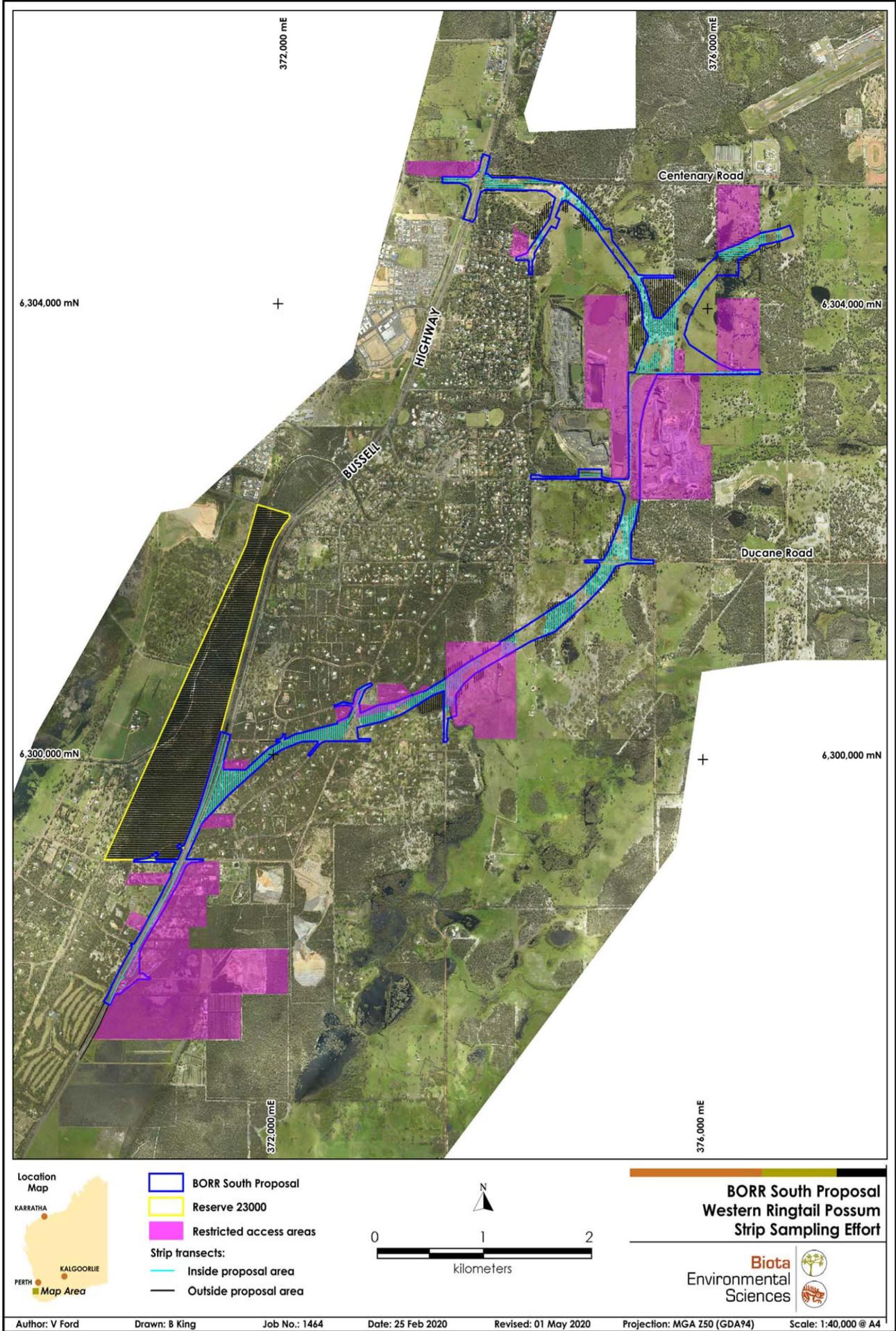


Figure 3.2: Western Ringtail Possum strip-sampling transects within the Proposal Area and Reference Site.

3.7 Brush-tailed Phascogale and Chuditch

The spotlighting methods applied to the sampling of Western Ringtail Possum were considered equally applicable to the Brush-tailed Phascogale and Chuditch.

3.8 Black-cockatoos

3.8.1 Breeding Habitat Assessment

This report provides a synthesis of the black-cockatoo breeding habitat assessment conducted in the Jilley Road to Bussell Highway portion of the Proposal Area in 2017 (Biota 2017) and further surveys to assess the remainder of the Proposal Area in spring 2018, summer 2018/2019 and finally any unsurveyed gaps between the indicative survey area and the Proposal Area in November 2019 (see Table 3.4 for dates of survey phases).

The field assessment aimed to determine whether suitable breeding habitat for black-cockatoos was present within the Proposal Area. The EPBC Act Referral guidelines in relation to Western Australia's three black-cockatoo species (DSEWPaC 2012a) defines breeding habitat as species of trees known to support breeding within the range of the black-cockatoo species, which either have a suitable nest hollow or are of a suitable diameter at breast height to develop a nest hollow (being greater than 50 cm DBH for most Eucalypts, or 30 cm in the case of Wandoo and Salmon Gum).

The aim was to assess, as far as practicable, all potential breeding trees within the Proposal Area. Two approaches were taken:

1. Larger areas of continuous vegetation were identified from aerial imagery and overlain with 25 m spaced transects in GIS. Using a GPS, a biologist walked up the middle of each 25 m wide transect, assessing all trees within it.
2. In smaller treed areas (e.g. roadside verges and paddocks containing singular trees), a biologist would maintain a GPS track file while using aerial imagery to visit as many trees as possible.

All individual trees of species with the potential to form hollows (primarily Jarrah, Marri and Tuart) and with sufficient diameter to be considered breeding habitat trees (DBH >50 cm) were recorded using a standard GPS (accurate to within 3 m). The position of trees observed to contain hollows that were potentially suitable for black-cockatoo nesting were recorded using a high accuracy GPS (accurate to within 1.5 m) and the following parameters were scored:

- tree height using a laser rangefinder;
- tree species;
- the number and height above the ground of observed hollows;
- the estimated size of entry of the hollow (being greater than 10 cm);
- whether the hollow was suitably open for access (i.e. not covered by branches);
- whether the orientation of the hollow was suitable for access (i.e. horizontal to upright; downward-facing hollows being unsuitable);
- whether the location of the hollow allowed for the formation of a nesting cavity (e.g. if on a spout branch, was the branch large enough to support a nesting cavity);
- signs of cockatoo use (including wear around hollows, nut chews, scarring, scratch marks on trunks and branches); and
- photographs were taken as a visual reference and to aid future identification of the tree.

3.8.2 Breeding Hollow Assessment

Black-cockatoos on the Swan Coastal Plain breed in large hollow-bearing trees, generally within woodlands and forests (Johnstone and Kirkby 2011). Hollow formation results from a number of

processes including fungal infection, termite activity and fire, and propensity for hollow formation varies between eucalyptus species (Whitford and Williams 2002). Studies on hollow formation in Jarrah/Marri forests identified a minimum tree age of 130 years before a tree would be suitable for hollow-dependent fauna (Whitford and Williams 2002). Habitat destruction, and the subsequent loss of suitable breeding hollows, has been identified as a process leading to population decline of black-cockatoos (Johnstone and Kirkby 2008). Furthermore, increased competition with both native and introduced species (e.g. ducks, Galahs and European Honey Bees) continues to reduce the availability of such trees for breeding sites (Johnstone et al. 2013).

Studies of the breeding behaviours of the three threatened black-cockatoo species have identified variation between the tree species and characteristics of hollows chosen for nesting (Table 3.5). For example, hollows formed in Jarrah are typically smaller than those in Marri, and Forest Red-tailed Black-cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the Southwest of WA (Johnstone et al. 2013). Breeding records of Carnaby's Black-cockatoo on the Swan Coastal Plain indicate that the majority of their nests are in Tuart (Johnstone and Kirkby 2011).

Table 3.5: Breeding habitat for the three Threatened black-cockatoo species.

	Baudin's	Carnaby's	Forest Red-Tailed
Specific breeding habitat for the three black-cockatoo species	Nest in hollows in live or dead trees of Karri, Marri, Wandoo and Tuart.	Nest in hollows in live or dead trees of Salmon Gum, Wandoo, Tuart, Jarrah, Flooded Gum, York Gum, Powderbark, Karri and Marri.	Nest in hollows in live or dead trees of Karri, Marri, Bullich, Swan River Blackbutt, Tuart and Jarrah.
Hollow Characteristics			
Aspect	No preference. Does not affect nesting success (Saunders 1979).	No preference. Does not affect nesting success (Saunders 1979).	–
Depth	Ranges from 0.1 to 2.5+ m (Johnstone and Kirkby 2011).	Majority between 0.5 and over 2.0 m, average just over 1 m (Saunders 1979).	1.0 - 5.0 m (Johnstone and Kirkby 2011).
Height above ground	No preference (Serventy and Whittell 1976).	No evidence that higher hollows are preferred (Saunders 1979).	No preference (Johnstone and Kirkby 2011).
Living or dead	No preference (Saunders 1979).	No preference (Saunders 1979).	No preference (Saunders 1979).
Entrance Diameter	–	–	>12 cm (Johnstone and Kirkby 2011).

Those hollows flagged as being potentially suitable for nesting during the ground assessment of breeding habitat (Section 3.8.1) were subject to a follow-up survey to more fully assess the suitability of these hollows using a remotely-piloted aircraft (RPA; DJI Mavic Pro). All hollows within the Proposal Area have been assessed at least once with the large majority having been surveyed twice. Those hollows in areas of overlap between the indicative survey boundary of 2018 and the current Proposal Area have been surveyed twice; in November 2018 and if categorised as potentially suitable then, they were reassessed in November 2019 for any evidence of nesting that may potentially have occurred in the intervening period. Those trees added to the Proposal Area after November 2018 received their first RPA assessment in November 2019.

On both occasions the RPA exercise was carried out by two environmental scientists, one of whom is also an experienced RPA pilot. A pre-flight assessment of the tree was completed to ensure proper flight conditions and confirm the order in which hollows would be assessed in cases where the tree supported more than one hollow requiring assessment. Prior to flight, the side of the tree was raked with a branch, which will generally cause any black-cockatoo or other bird species within a hollow to emerge. This provides an indication of hollow use and also reduces the likelihood of RPA-fauna collision.

During the flight stage of the RPA survey: (i) the pilot was responsible for flying the RPA, and (ii) the spotter monitored the surroundings to ensure the aircraft was not in close proximity to branches and informed the pilot if any birds fled the hollows.

Photographs of the hollows were then assessed in detail to determine if they actually represented suitable hollows and/or if they showed any signs of current or previous use by black-cockatoos (e.g. chew marks around the hollow entrance).

Breeding suitability of the hollows examined was categorised as per Table 3.6.

Table 3.6: Categories of hollow suitability for black-cockatoo nesting.

Category	Characteristics
Potentially Suitable (with evidence consistent with black-cockatoo use)	As for "Potentially suitable" below, but also showing evidence of use consistent with black-cockatoos. Examples include: <ul style="list-style-type: none"> • Fresh chews around the rim and inside of the hollow. • Eggs that were similar in appearance to those of black-cockatoos.
Potentially Suitable	<ul style="list-style-type: none"> • Entrance greater than 12 cm. • Branch width and depth large enough to support a nesting chamber. • Angle of entrance/egress suitable for black-cockatoo.
Unlikely Suitable	Hollows with an entrance greater than 12 cm, but other required criteria of a Potentially Suitable hollow were absent.
Not Suitable	Not a hollow, or hollow not suitable for black-cockatoo nesting.
Ground Assessment Only	The hollow could only be assessed from the ground due to limitations with RPA access (e.g. proximity to road traffic, within a prescribed no-fly zone, foliage covering hollow, etc).

3.8.3 Foraging Habitat Assessment

Foraging habitat is defined as areas including plants of species known to support foraging within the range of each cockatoo species. Marri and Jarrah woodlands are particularly important to Baudin's Black-Cockatoo and the Forest Red-tailed Black-Cockatoo, while proteaceous heaths (i.e. shrublands dominated by *Banksia*, *Hakea* and *Grevillea* species) are also important to Carnaby's Black-Cockatoo (DSEWPaC 2012a), as are areas of introduced pine species, particularly on the Swan Coastal Plain (Johnstone and Kirkby 2011).

In considering the quality of foraging habitat in relation to black-cockatoos the criteria detailed in both the current referral guideline (DSEWPaC 2012a) and the draft revised referral guideline (DoTEE 2017) were considered. These include foraging plant composition and density, the provision of continuity to wider areas of foraging habitat, foraging evidence, proximity to known roosting areas and proximity to known breeding areas.

While conducting assessments of breeding habitat in the areas shown in Figure 4.6 and Figure 4.7, foraging habitat and foraging evidence were opportunistically recorded. Not all locations of foraging evidence were recorded, as these were too numerous for this to be practicable. However, generally any first encounter with foraging evidence within a vegetation fragment was recorded and subsequent encounters were also recorded if they were indicative of an additional species utilising the area.

3.9 Limitations

A number of potential limitations, including those identified in EPA (2016b), have been considered in relation to the study (Table 3.7).

Table 3.7: Assessment against potential survey limitations.

Potential Limitation	Assessment
Availability of contextual information at a regional and local scale	<ul style="list-style-type: none"> • To provide context for estimates of Western Ringtail Possum numbers in the Proposal Area, additional sites outside the Proposal Area were sampled using consistent methodology. • Considerable context in relation to the Western Ringtail Possum, both local and regionally are detailed in this report from survey conducted by Biota as well as additional surveys by other authors detailed in (Table 3.2). • Eight targeted black-cockatoo surveys, unrelated to the BORR project, within 20 km of the Proposal Area were reviewed Table 3.2. • Contextual information was not considered a limitation.
Competency / experience of the team carrying out the survey, including experience in the bioregion surveyed	<ul style="list-style-type: none"> • The field personnel conducting the work were all suitably qualified. • The use of RPAs to conduct hollow assessments is a relatively new approach. Improvements were made to the methodology and interpretations throughout the survey work. • A core group of personnel completed all survey phases to standardise recording as far as practicable. • Competency was not considered to be a limitation.
Proportion of fauna recorded and/or collected, any identification issues	<ul style="list-style-type: none"> • In some cases, identifying white-tailed black-cockatoos to species level was not possible when they were at a distance or heard only. • In some areas, discerning Flooded Gum from Tuart was difficult due to lack of visible fruit. In this situation, species was assigned based on habitat and other elements of tree morphology (for example, Flooded Gum tended to be more stunted and have lower branches). • There is potential for suitable breeding hollows to be missed, as recorders were limited in detecting hollows from ground level and their view may have been blocked by foliage or the aspect of the hollow entrance. • The target species (particularly Western Ringtail Possum and black-cockatoos) were intensively surveyed and proportion of fauna and identification issues were not considered a limitation.
Appropriate area fully surveyed (effort and extent)	<ul style="list-style-type: none"> • This study targeted specific fauna species of conservation significance, and comprehensively sampled the occurrence of habitat for these species within the Proposal Area. • Practically all treed habitat within the Proposal Area was assessed for its potential to represent black-cockatoo habitat. • Although some areas were inaccessible for the survey of the Western Ringtail Possum on occasion (at landholder request), the large majority of the Proposal Area was surveyed on more than one occasion. • The extent of survey was not considered to be a limitation.
Access restrictions within the survey area	<ul style="list-style-type: none"> • Access within the survey area was not considered a limitation for the current study (see point above).
Survey timing, rainfall, season of survey (timing / weather / season / cycle)	<ul style="list-style-type: none"> • Survey timing was not considered to be a limitation to the assessment of breeding habitat for black-cockatoos and the survey of Western Ringtail Possum and surveys spanning multiple seasons have now been incorporated.
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey	<ul style="list-style-type: none"> • Disturbances were not considered a limitation to the survey.

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4.0 Results

4.1 Desktop Review

Tables detailing all species returned from the desktop review are presented as Appendix 3. Database search results, together with four studies within 10 km of the Proposal Area, yielded a combined species inventory of 223 vertebrate fauna species, comprising 25 mammals (14 native non-volant mammals, one bat and 10 non-native species), 159 birds (63 of which are largely reliant on freshwater or marine habitats), 29 reptiles and 10 amphibians.

A total of 21 of these species are of conservation significance; these are considered in more detail in Section 4.5.

4.2 Fauna Habitats

Approximately 124.34 ha of the 199.73 ha Proposal Area represents land historically cleared for agriculture, housing and road infrastructure while 75.39 ha of predominantly native vegetation remains. Ground-truthing and habitat mapping was conducted over all vegetation within the Proposal Area to ensure that all potential black-cockatoo habitat trees were captured.

Three broad fauna habitats were described from on-site descriptions and vegetation mapping conducted by the BORR Integrated Project Team (2019). Some refinement of fauna habitat within vegetation units was necessary; for example, Eucalypts within a road reserve were considered to represent a different fauna habitat to a large fragment. The three broad fauna habitats described for the Proposal Area are detailed in Table 4.1, while their extent is illustrated in Figure 4.1 and Figure 4.2. The habitats comprised Marri/*Eucalyptus* woodland (43.71 ha), Marri/*Eucalyptus* scattered trees in paddocks and road reserves (21.65 ha) and *Melaleuca* shrubland and/or woodland (9.72 ha). The mid-storey and lower strata of the Marri/*Eucalyptus* woodland varied throughout the Proposal Area, particularly in the predominance of *Agonis* and *Banksia*.

The Marri/*Eucalyptus* woodland habitat of the Proposal Area was dominant in the Jilley Road to Bussell Highway portion of the Proposal Area. Dampland supporting *Melaleuca* shrubland and/or woodland was for the most part located in the northern portion of the Proposal Area. Only one area was found to support free water, despite much higher than average winter rainfall preceding the 2018 survey, suggesting that these dampland areas are rarely inundated.

A considerable proportion of the vegetation occurred as single trees or small stands within paddocks and road reserves. Both of these habitat types have the potential to represent linkages that allow fauna to disperse throughout the landscape, although their usefulness is likely to vary considerably between species depending on their mobility (e.g. black-cockatoos greater than Western Ringtail Possum). For paddock remnants, their usefulness as stepping-stones may be reduced in instances where they are fenced or there is little or no understorey due to grazing.

A limitation of any habitat classification system is that it is not specific to any one species. Rather, the classification provides a convenient framework to summarise species occurrence. When considering habitat for individual species of elevated conservation significance, the habitat availability within the Proposal Area has been considered in relation to particular species requirements and this is detailed in Section 4.5.

Table 4.1: Broad fauna habitats of the Proposal Area.

Broad Fauna Habitat	Example Photographs	
<p>Marri/Eucalyptus woodland</p> <p>Jarraah (<i>Eucalyptus marginata</i>) and Marri (<i>Corymbia calophylla</i>) dominated overstorey, varying understorey of Banksia (<i>Banksia attenuata</i> and <i>B. grandis</i>) and/or Peppermint (<i>Agonis flexuosa</i>).</p> <p>43.71 ha</p>		
<p>Marri/Eucalyptus in paddocks and road reserves</p> <p>Typically occurring as widely spaced trees or occasionally as small stands in paddocks; comprising a mosaic of scattered trees of Marri and/or Flooded Gum. When occurring as small stands, the midstorey typically comprised <i>Melaleuca</i> or Peppermint and the heavily grazed understorey comprised introduced grasses.</p> <p>21.66 ha</p>		

Broad Fauna Habitat	Example Photographs	
<p data-bbox="129 146 595 172">Melaleuca shrubland and/or woodland</p> <p data-bbox="129 213 654 363">Shrubland or woodland of Moonah (<i>Melaleuca preissiana</i>) or Swamp Paperbark (<i>Melaleuca raphiophylla</i>), typically over sedges or introduced grasses in dampland areas but also occurs in road reserves.</p> <p data-bbox="129 405 232 430">10.02 ha</p>		

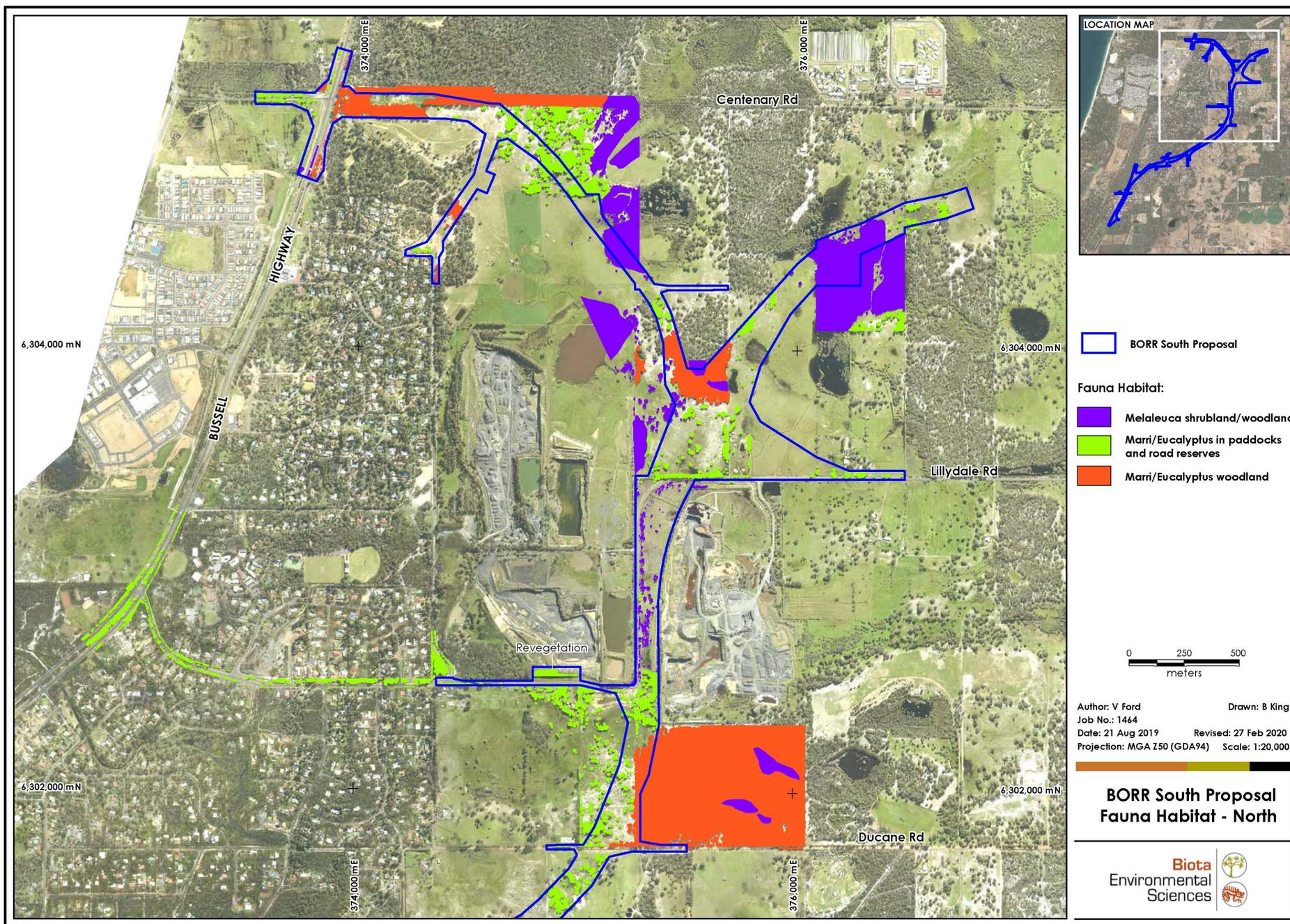


Figure 4.1: Broad fauna habitats of the Proposal Area (north map 1/2).

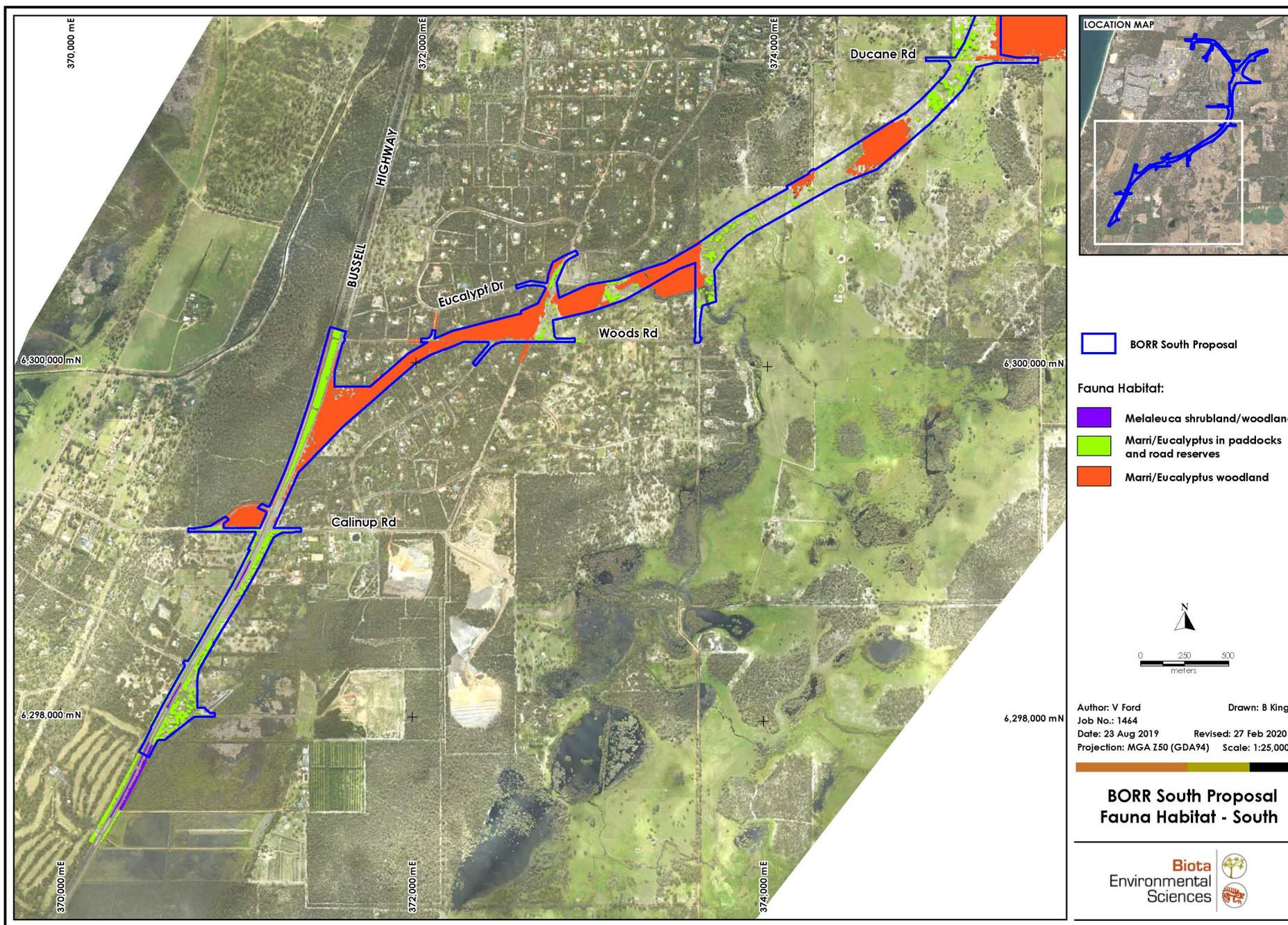


Figure 4.2: Broad fauna habitats of the Proposal Area (south map 2/2).

4.3 Western Ringtail Possum

The number of Western Ringtail Possum observations and the total number of individuals recorded for the four phases of strip-sampling conducted in 2019 - 2020 are presented in Table 4.2 for both the Proposal Area and Reference Site.

The total number of individuals in the Proposal Area ranged from a minimum of 53 in August 2019 to a maximum of 79 in December 2019 with an average of 68.75 individuals. The lower numbers in the August 2019 survey phase may partly reflect access restrictions reducing the total area available for survey. Of the total 75.39 ha targeted for sampling, 8.19 ha was unavailable in August while in later phases access restrictions affected between 2.48 ha and 4.18 ha. The three more recent phases of sampling were more comparable in total area of habitat surveyed with fewer access restriction and the number of individuals recorded was also more similar; 76 in October 2019, 79 in December 2019 and 67 in February 2020. Single adults and pairs of adults were the most common type of observation, however, females with young (either on back or at heel) were also recorded in all phases of strip-sampling.

The number of individuals recorded within the Reference Site was 165 in November 2019, 175 in December 2019 and 136 in February 2020 (Table 4.2); a pattern which followed the rise and fall in abundance recorded within the Proposal Area over the same timeframe. As such, the ratio of abundance in the Reference Site to the Proposal Area was very consistent across the three phases in which they were both surveyed, with the Reference Site consistently having an abundance 2.0 – 2.2 times that of the Proposal Area.

Table 4.2: Western Ringtail Possum strip-sampling records within the Proposal Area and Reference Site.

		Adult (single)		Adult group (2+)		Mother with young		Independent subadult		Total	
		Proposal	Reference	Proposal	Reference	Proposal	Reference	Proposal	Reference	Proposal	Reference
Aug-19	Observations	31	-	9	-	2	-	0	-	42	-
	Individuals	31	-	18	-	4	-	0	-	53	-
Oct-19/ Nov-19¹	Observations	40	84	13	34	5	5	0	0	58	123
	Individuals	40	84	26	71	10	10	0	0	76	165
Dec-19	Observations	44	102	13	26	4	9	0	1	61	138
	Individuals	44	102	27	54	8	18	0	1	79	175
Feb-20	Observations	39	100	7	7	6	11	2	0	54	118
	Individuals	39	100	14	14	12	22	2	0	67	136
Average	Observations	38.50	95.33	10.50	22.33	4.25	8.33	0.50	0.33	53.75	126.33
	Individuals	38.50	95.33	21.25	46.33	8.50	16.67	0.50	0.33	68.75	158.67

1: Proposal Area mid-Oct-2019, Reference Site early-Nov-2019, see Table 3.4 for survey dates.

Sampling for the Western Ringtail Possum was conducted in all three of the broad habitat types within the Proposal Area and the species was recorded in both the *Marri/Eucalyptus* woodland and *Marri/Eucalyptus* in paddocks and road reserves but was almost completely absent from *Melaleuca* shrubland and/or woodland habitat. The number of Western Ringtail Possum individuals recorded as a function of habitat and phase is detailed in Table 4.3 with an approximate density for each habitat, based on the area of each. Although the highest densities of Western Ringtail Possum were observed in the larger woodland fragments, the density within the *Marri/Eucalyptus* in Paddocks and Road Reserves was only slightly less despite the scattered nature of the habitat trees and often grazed understorey (Table 4.3).

The average density of Western Ringtail Possums in the 75.39 ha of surveyed habitat was 0.91 individuals per hectare. Given that this survey included the large majority of habitat available, we may also present this as a Proposal Area density of 0.34 individuals per hectare (199.73 ha). The neighbouring Reference Site was 146.1 ha in size and found to support an average of 158.67 Western Ringtail Possums for a density of 1.09 individuals per hectare.

The locations of Western Ringtail Possum observations during the four phases of strip-sampling survey are displayed in Figure 4.3 and Figure 4.4. The multiple phases of strip-sampling within the Proposal Area delineate areas of consistent presence of Western Ringtail Possums.

Table 4.3: Western Ringtail Possum abundance and density (individuals per hectare) for each habitat type and phase of strip-sampling within the Proposal Area.

	<i>Marri/Eucalyptus</i> Woodland (43.71 ha)		<i>Marri/Eucalyptus</i> in Paddocks and Road Reserves (21.66 ha)		<i>Melaleuca</i> Shrubland and/or Woodland (10.02 ha)		Total Individuals	Average Density	
	Individuals	Density	Individuals	Density	Individuals	Density		Surveyed habitat	Proposal Area
Aug-19	42	0.96	11	0.51	0	0.0	53	0.70	0.27
Oct-19	51	1.17	25	1.15	0	0.0	76	1.01	0.38
Dec-19	63	1.44	14	0.65	2	0.2	79	1.05	0.40
Feb-20	40	0.92	26	1.20	1	0.1	67	0.89	0.34
Avg.	49	1.12	19	0.87	0.75	0.075	68.75	0.91	0.34

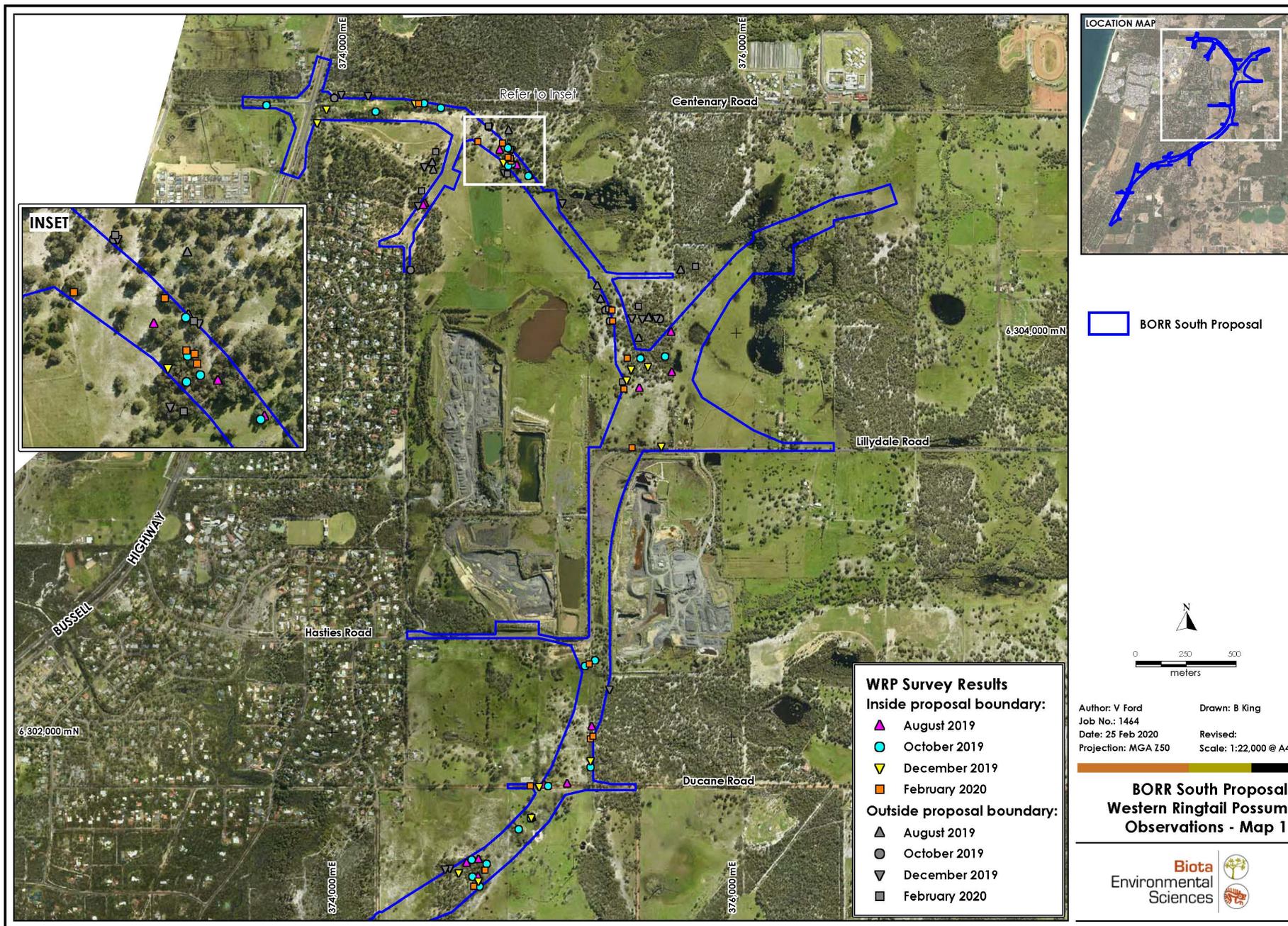


Figure 4.3: Records of Western Ringtail Possums from strip transects across the Proposal Area (north Map1/2).

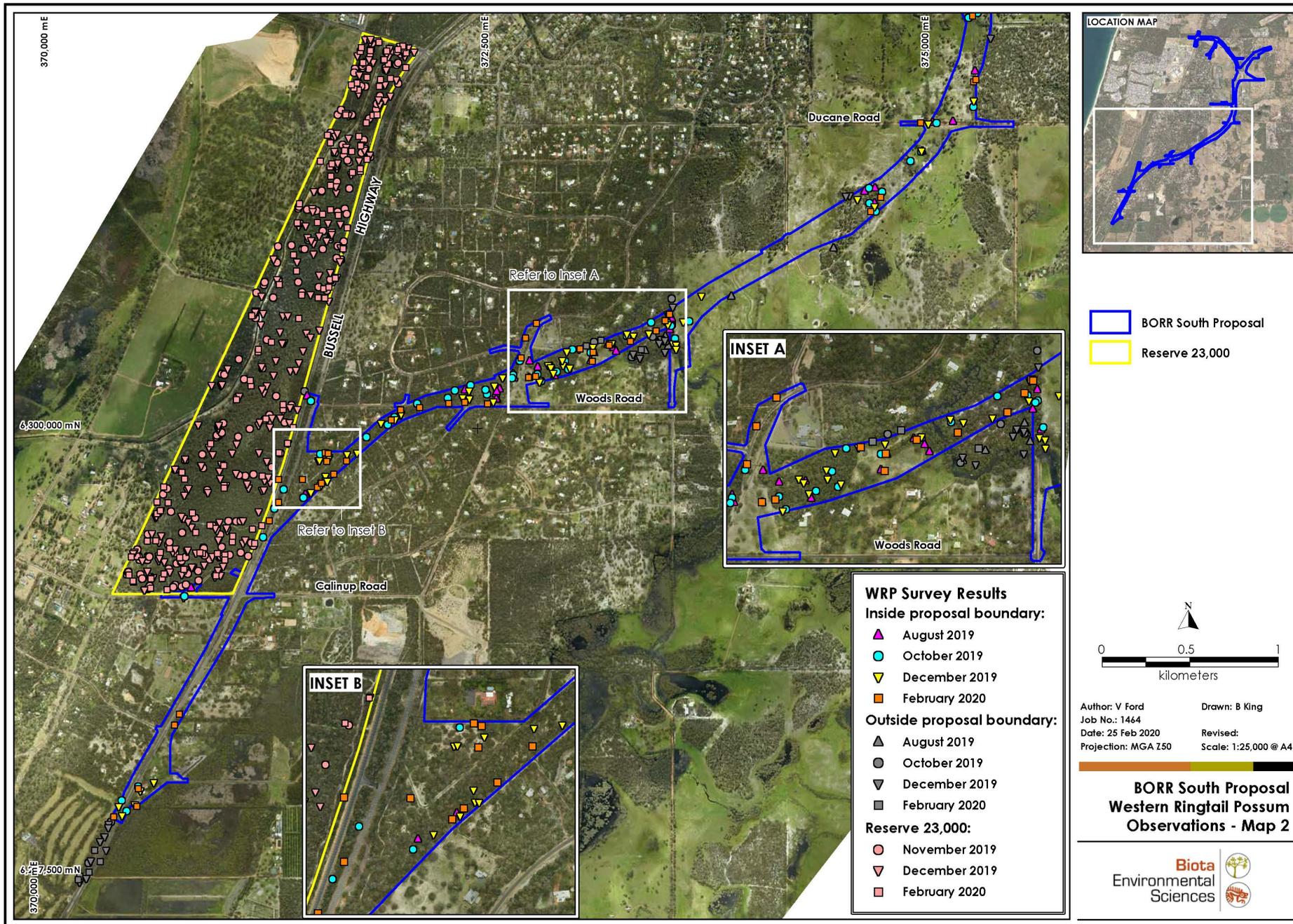


Figure 4.4: Records of Western Ringtail Possums from strip transects across the Proposal Area (south Map 2/2).

4.4 Black-cockatoos

4.4.1 Observations

Black-cockatoos were recorded within the Proposal Area on one occasion and in close proximity on an additional three occasions. The record within the Proposal Area was of five Carnaby's Black-Cockatoo flying over. Nearby the Proposal Area, Forest Red-tailed Black-Cockatoos were recorded on two occasions and a group of eight white-tailed black-cockatoos (not identifiable to species) were observed flying over. The locations of black-cockatoo observations are shown in Figure 4.5.

4.4.2 Breeding Habitat Assessment

Black-cockatoo breeding habitat trees were considered to be those of relevant species with a DBH of 50 cm or greater as defined in the Commonwealth Referral guidelines (DSEWPaC 2012a). A total of 1,109 suitable DBH trees were recorded within the Proposal Area, comprising 623 Marri, 298 Jarrah, 116 Tuart, eight Flooded Gum and 64 of indeterminate species (largely dead trees and a small number of introduced Eucalypts). Of the 1,109 habitat trees, 115 trees with hollows were the subject of a separate hollow-suitability assessment using an RPA, as described in Section 4.4.2.1.

The survey extent and locations of all trees with greater than 50 cm DBH are shown in Figure 4.6 and Figure 4.7.

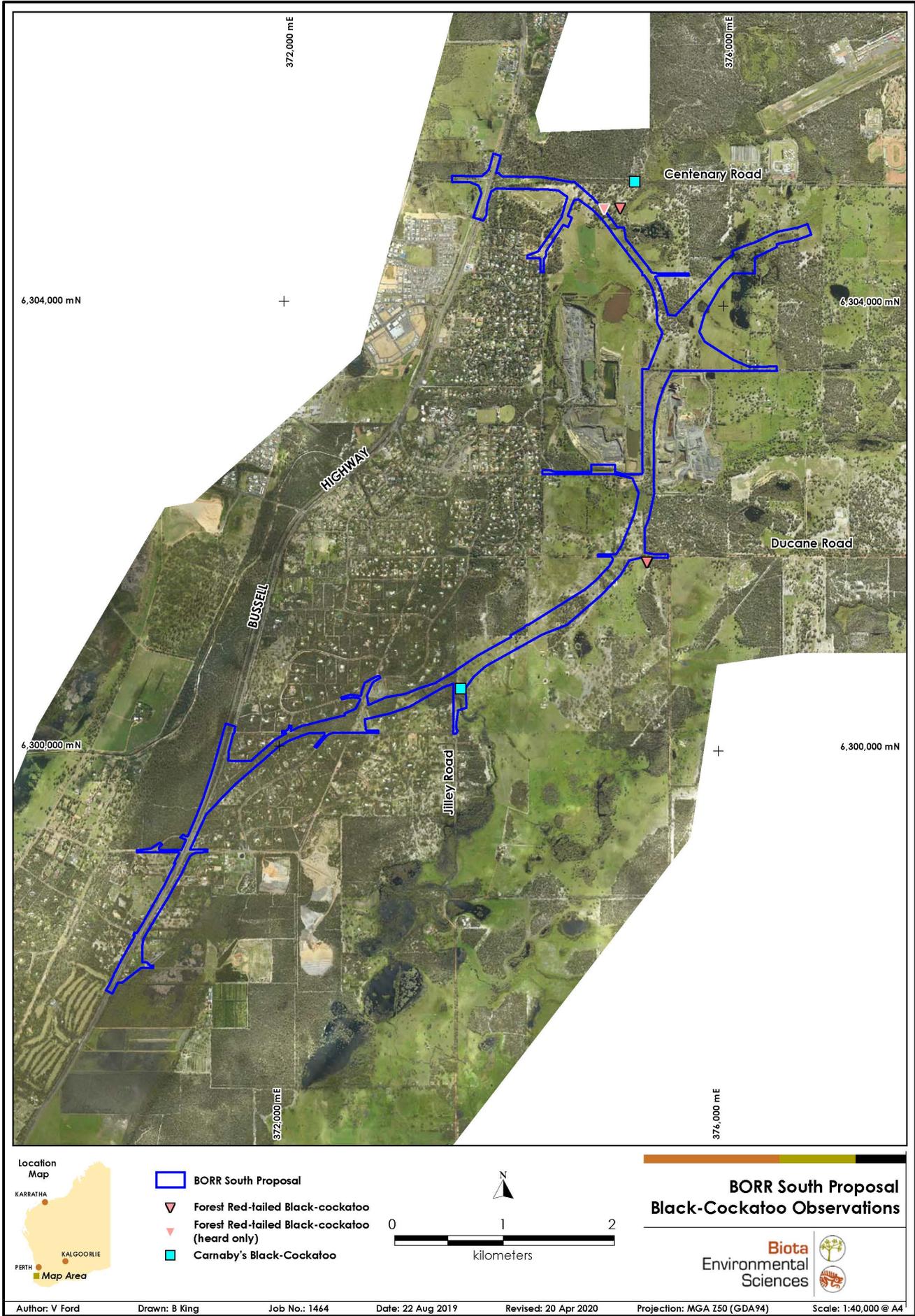


Figure 4.5: Black-cockatoo observations in relation to the Proposal Area.

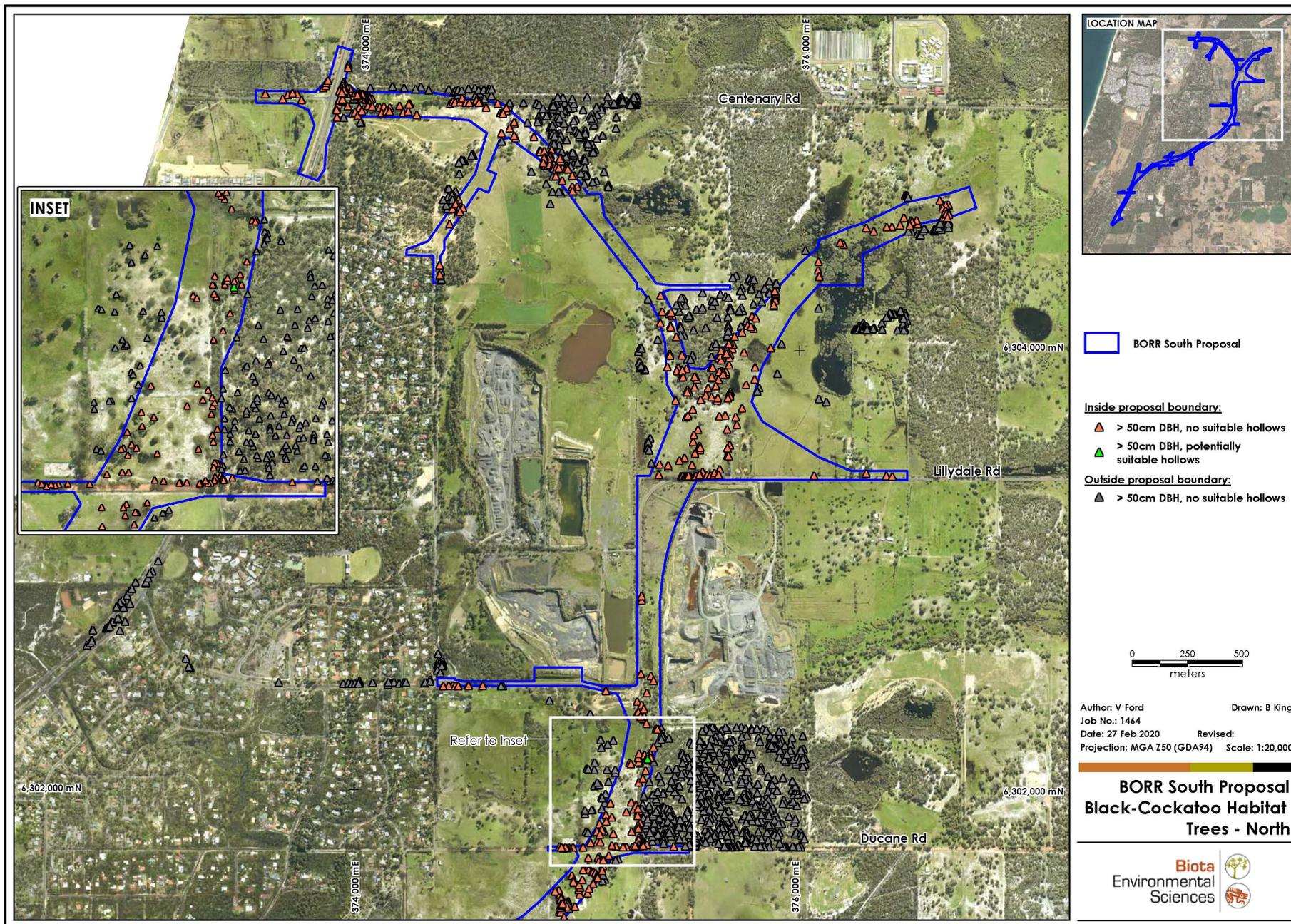


Figure 4.6: Trees >50 cm DBH of hollow-forming species recorded within the Proposal Area, including those bearing potentially suitable black-cockatoo breeding hollows (north map 1/2).

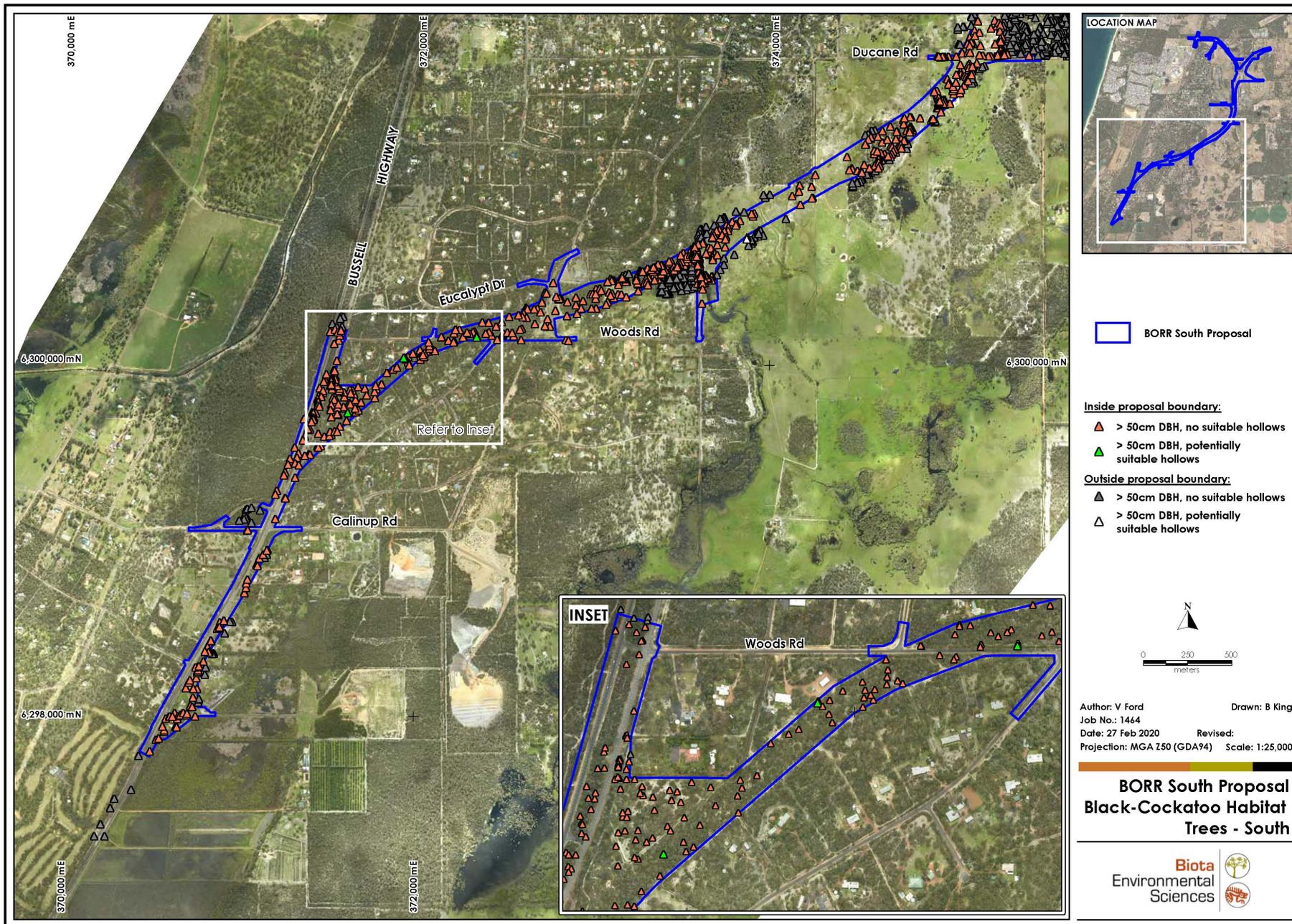


Figure 4.7: Trees >50 cm DBH of hollow-forming species recorded within the Proposal Area, including those bearing potentially suitable black-cockatoo breeding hollows (south map 2/2).

4.4.2.1 Cockatoo Hollow Assessment

Of the 115 trees included in the hollow assessment, five trees were found to have a hollow potentially suitable for black-cockatoo nesting and two of these hollows contained potential evidence of nesting; one had 3+ large eggs (black-cockatoos normally lay two) but no chew marks were visible around the hollow entrance while a second appeared to have chew marks around the hollow. An example photograph of each of the potentially suitable hollows is presented as Plate 4.2 – Plate 4.9 (some plates represent before and after processing to compare external and internal structure).

Of the remainder of the trees, 26 were classified as having hollows unlikely to support nesting, and 76 trees were classified as definitively not suitable while an addition eight trees had hollows that were not accessible with the RPA. The results of the hollow assessment are displayed in Figure 4.8 and Figure 4.9. In this figure, for trees that had multiple hollows, the symbology represents the most suitable hollow.

No direct signs of black-cockatoo breeding have been observed in this study, that is, cockatoos were not observed returning to hollows to nest or tend to chicks. However, a likely Forest Red-tailed Black-cockatoo egg was found on the ground in the vicinity of breeding habitat trees during the 2017 study (Plate 4.1).



Plate 4.1: Forest Red-tailed Black-cockatoo eggshell found on the ground in 2017.



Plate 4.2: Potentially Suitable Hollow (Tree ID: 33)



Plate 4.3: Potentially Suitable Hollow (Tree ID: 33) Post-processing



Plate 4.4: Potentially Suitable Hollow (Tree ID: 171)



Plate 4.5: Potentially Suitable Hollow (Tree ID: 171) Post-processing (3-4 eggs shells present.)



Plate 4.6: Potentially Suitable Hollow (Tree ID: 269)



Plate 4.7: Potentially Suitable Hollow (Tree ID: 269) Post-processing



Plate 4.8: Potentially Suitable Hollow (Tree ID: 272). Two Southern Boobooks.



Plate 4.9: Potentially Suitable Hollow (Tree ID: 327) Post-processing

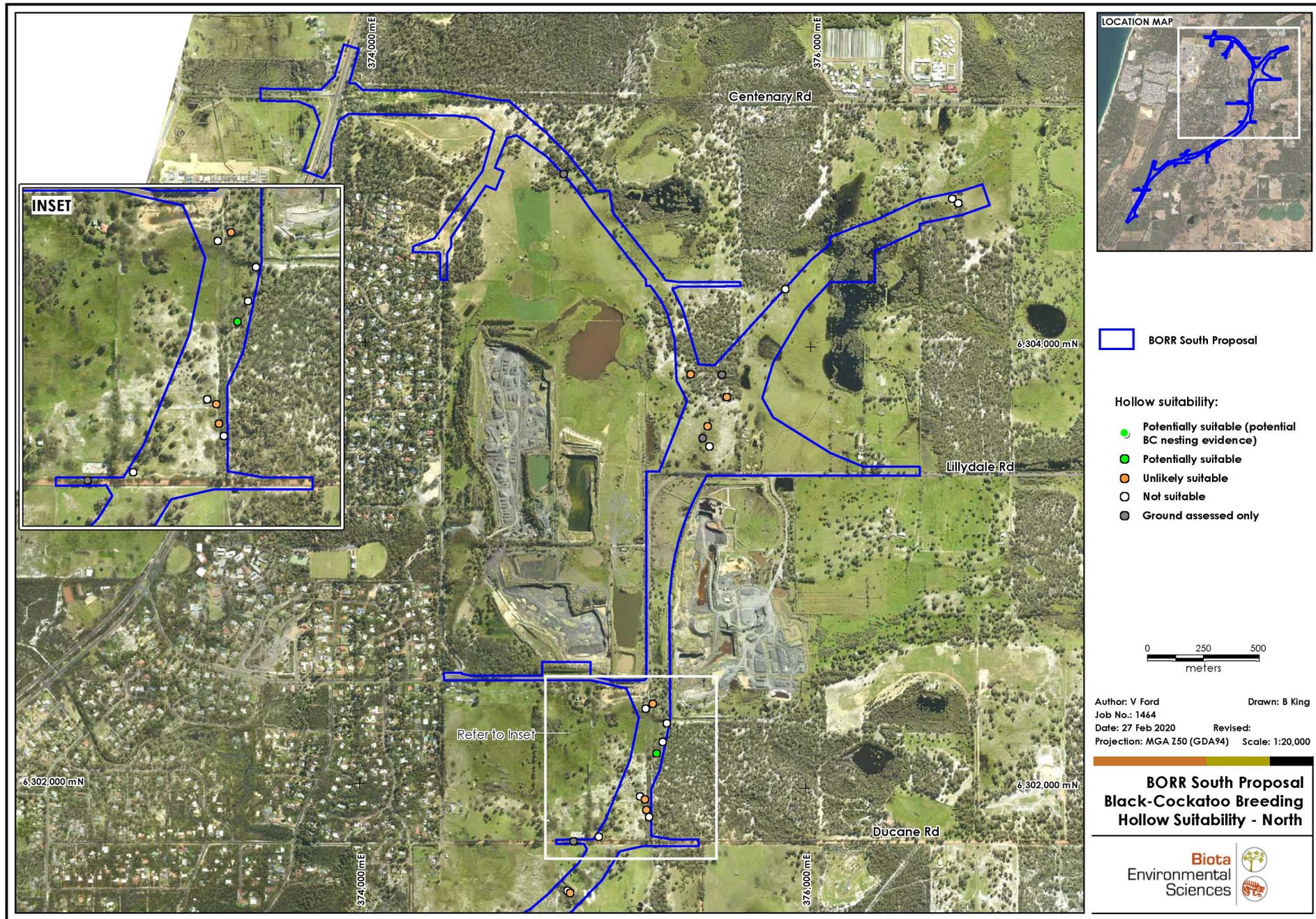


Figure 4.8: Black-cockatoo breeding hollow suitability (north map 1/2).
 For multi-hollow trees, status of the most suitable hollow shown.

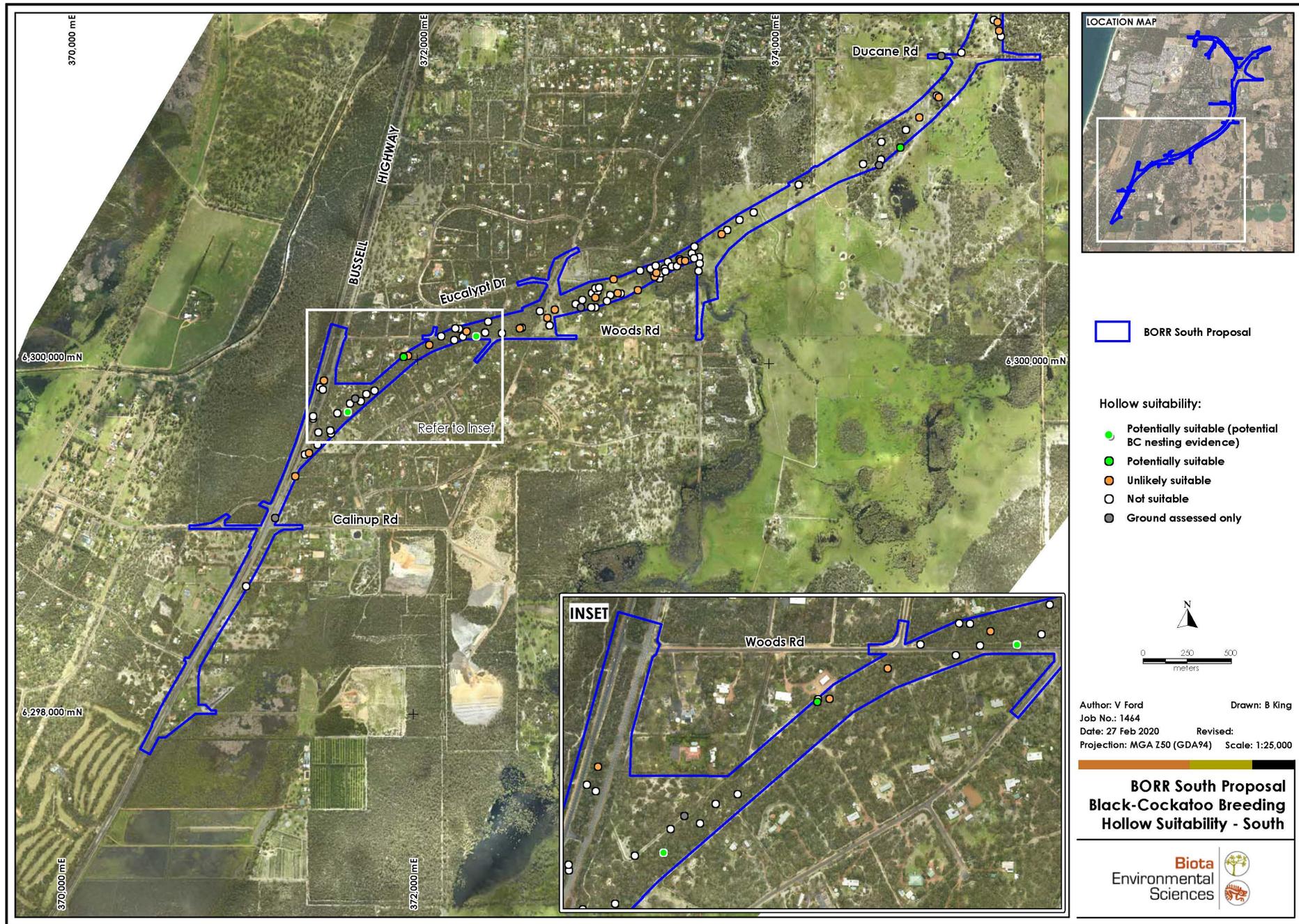


Figure 4.9: Black-cockatoo breeding hollow suitability (south map 2/2).

For multi-hollow trees, status of the most suitable hollow shown.

4.4.3 Foraging Habitat

The Swan Coastal Plain is primarily of importance to black-cockatoo species as a feeding ground, and only small and specific areas support breeding (DotEE 2017). As such, consideration of available foraging habitat in the Proposal Area is perhaps the most important aspect when considering potential impacts to black-cockatoos. Evidence of foraging by all three species of black-cockatoo was recorded, with Forest Red-tailed Black-Cockatoo and Carnaby's Black-Cockatoo foraging most commonly recorded. Marri nuts with chew marks indicative of Baudin's Black-cockatoo were also located in lesser numbers. Examples of Marri nuts with chew marks of each black-cockatoo species are shown as Plate 4.10 to Plate 4.12.

With Bunbury listed as a known breeding area for Carnaby's Black-Cockatoo and Baudin's Black-Cockatoo (DotEE 2017), and the presence of known white-tailed black-cockatoo roosts in nearby locations including Gelorup, College Grove and Glen Iris (Peck et al, 2018), the importance of foraging habitat within the Proposal Area is increased. The 43.71 ha of Marri/*Eucalyptus* woodland habitat type was classified as high quality foraging habitat; these areas supported a high density of foraging trees (primarily Marri and Jarrah) in the upper strata but also often also included *Banksia* in the mid-storey.

A further 21.66 ha of Marri/*Eucalyptus* in paddocks and road reserves was classified as moderate quality foraging habitat. While not high quality foraging habitat, these areas contained scattered foraging plants and have potential to represent a linkage to larger habitat remnants.

Much of the Proposal Area was devoid of black-cockatoo foraging habitat, having been historically cleared, or consisting of non-native vegetation or native vegetation that did not contain foraging plants (e.g. *Melaleuca* shrubland or woodland, *Astartea* shrubland). Together these areas represented 134.37 ha or 67.27% of the Proposal Area.



Plate 4.10: Carnaby's Black-Cockatoo Marri nut chew.



Plate 4.11: Baudin's Black-Cockatoo Marri nut chews.



Plate 4.12: Forest Red-tailed Black-Cockatoo Marri nut chews.

The black-cockatoo foraging habitat within the Proposal Area has been considered in the context of wider habitat availability in Figure 4.10 by mapping the occurrence of each Swan Coastal Plain vegetation complex (DPaW 2017b), both within the Proposal Area and out to a 12 km radius. This radius was chosen as it represents the typical maximum distance that black-cockatoos will fly from roosting locations to forage.

Four vegetation complexes occur within the Proposal Area (SCP Veg. 42, 44, 49 and 56); each is defined in Table 4.4 and their occurrence (in hectares) both within the Proposal Area and out to a 12 km radius is presented.

The large majority of the vegetation within the study area is mapped as SCP Veg. 44 and 49; together these comprise 90% of the native vegetation and both are dominated by suitable foraging plants for black-cockatoos. The combined area of these two complexes within the Proposal Area represents 1.2% of their extent within a 12 km radius. Bassendean Complex Central and South (SCP Veg. 44) occurs in fragments throughout the northern half of the Proposal Area. Lot 1 Ducane Road, located directly east and adjacent to the Proposal Area, represents an undisturbed example of this habitat type. The Karrakatta Complex-Central and South (SCP Veg. 49) occurs in the Jilley Road to Bussell Highway section of the Proposal Area and is contiguous with this same complex adjacent to the corridor, although it is intersected by roads and housing.

The Southern River Complex (SCP Veg. 42) generally comprises Marri, Jarrah and *Banksia* so represents favourable foraging habitat. This complex occurs as small isolated fragments within the Proposal Area, while significant large areas of the complex occur directly to the north of the Proposal Area (e.g. in Manea Park). Little of the Yoongarillup Complex (SCP Veg. 56) remains in the local area. Of the vegetation complexes within the Proposal Area, this complex represents lower quality foraging habitat for black-cockatoos, being generally devoid of preferred foraging plants (e.g. Marri, Jarrah and *Banksia*).

Table 4.4: Occurrence of the Swan Coastal Plain vegetation complexes (DPaW 2017b) within the Proposal Area and within a 12 km radius.

SCP Veg.	Complex Name	Complex Definition	Area in Proposal Area (ha)	Amount Remaining Within 12 km (ha)
49	Karrakatta Complex – Central and South	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> - <i>Banksia</i> species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.	34.59	2,840.35
44	Bassendean Complex – Central and South	Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (Jarrah) - <i>Allocasuarina fraseriana</i> (Sheoak) - <i>Banksia</i> species to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>Eucalyptus marginata</i> to <i>Eucalyptus tottiana</i> (Pricklybark) in the vicinity of Perth.	14.81	1,162.15
42	Southern River Complex	Open woodland of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> species with fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca raphiophylla</i> (Swamp Paperbark) along creek beds.	3.93	2,397.4
56	Yoongarillup Complex	Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterized by <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species open forests.	1.22	336.6

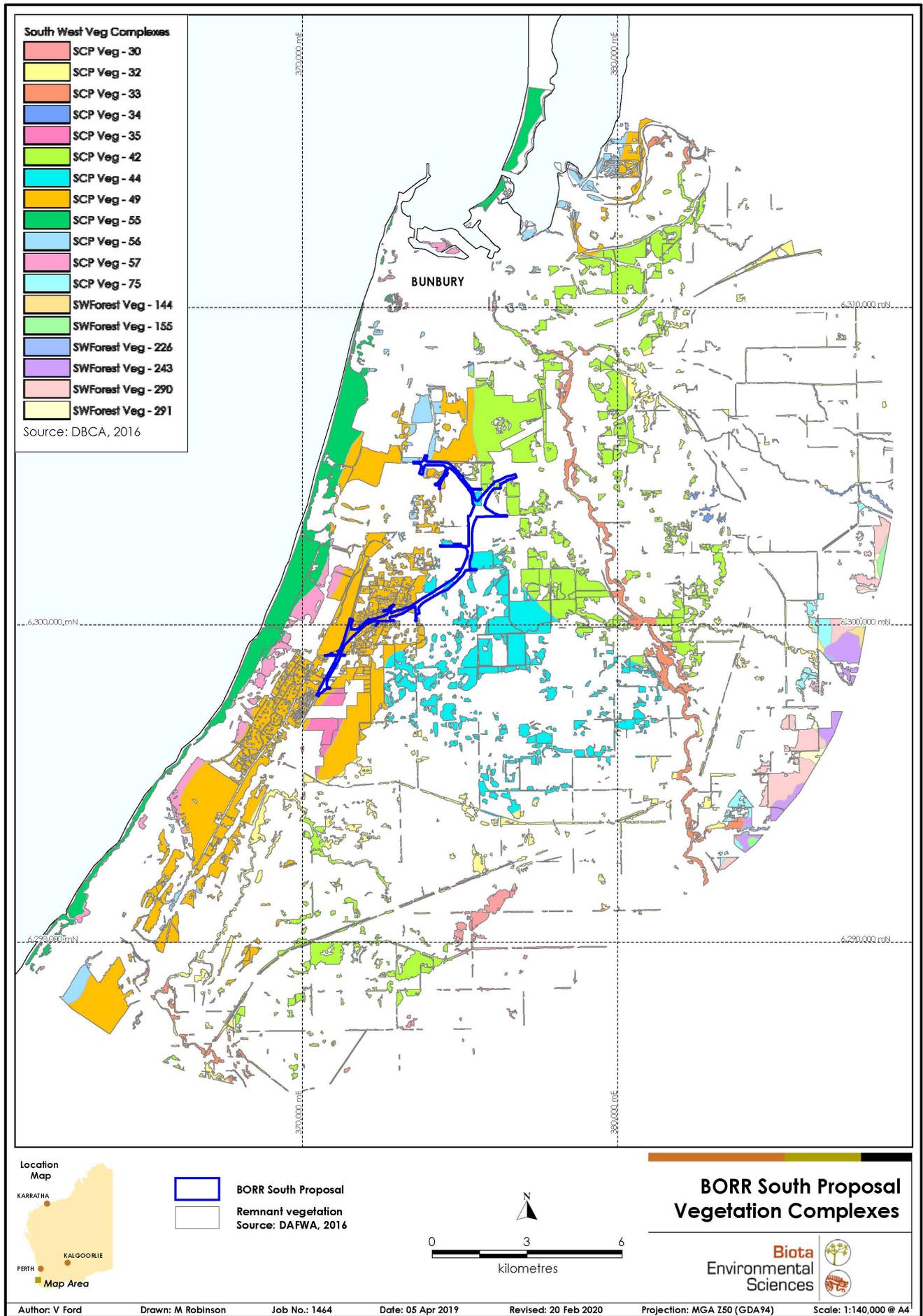


Figure 4.10: Remnant vegetation and Swan Coastal Plain Vegetation Mapping (DPaW 2017b) within a 12 km radius of the Proposal Area.

4.5 Brush-tailed Phascogale

Four individual Brush-tailed Phascogales were recorded within the Proposal Area; three in the December 2019 phase of strip-sampling and one in the February 2020 phase. Records of the species consistently came from the area north of Lillydale Road, both within the Proposal Area and directly adjacent where the woodland is contiguous. At the Reference Site, 22 Brush-tailed Phascogales have been recorded in the recent strip-sampling phases. Figure 4.11 displays records of the Brush-tail Phascogale in relation to the Proposal Area and Reference Site.

The species has most commonly been recorded within the *Marri/Eucalyptus* woodland type within the Proposal Area and Reference Site but has also been observed in a variety of tree species within this habitat type including *Marri*, *Jarraah*, *Banksia* and also occasionally *Peppermint*.

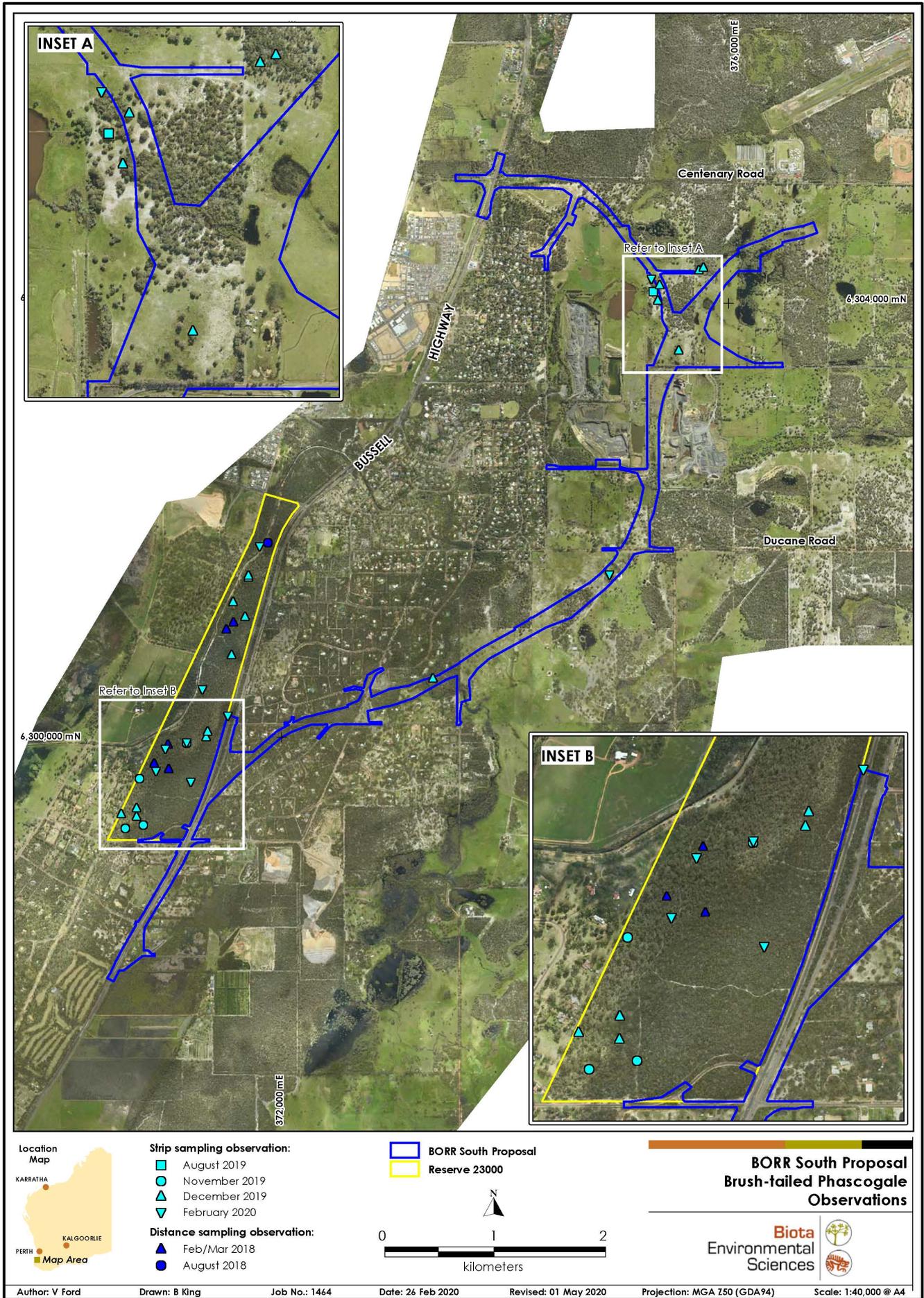


Figure 4.11: Records of the Brush-tailed Phascogale from within the Proposal Area and contextual sites nearby.

5.0 Conservation Significant Species

This section provides an assessment of the likelihood of occurrence of the target species and other conservation significant fauna species returned from the desktop; that is, those species protected by the EPBC Act, BC Act or listed as DBCA Priority species. Appendix 1 details categories of conservation significance recognised under these three frameworks.

As defined in Section 3.2, the assessment of likelihood of occurrence for each species has been made based on availability of suitable habitat, whether it is core or secondary, as well as records of the species during the current or past studies included in the desktop review.

Table 5.1 details the likelihood assessment for each conservation significant species returned from the desktop review. Further species information is provided in Sections 5.1 to 5.3.

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Table 5.1: Conservation significant fauna returned from the desktop review and their likelihood of occurrence within the Proposal Area.

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	Lot 15 (2010)	BORR (2012)	Lot 1 Ducane (2014)	Waterloo (2015)	Nearest Record in km (year), No. of Nearby Records	Marri / Eucalyptus woodland	Marri / Eucalyptus in paddocks and road reserves	Melaleuca shrubland and/or woodland	Notes	Likelihood of Occurrence
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1	CR	•	•	•	•	•	•	0.05 (2017), 1489	Foraging Breeding	Foraging Breeding		Resident.	Occurs
<i>Calyptrorhynchus baudinii</i>	Baudin's Black-Cockatoo	S2	EN	•	•					2.4 (1999), 26	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Calyptrorhynchus latirostris</i>	Carnaby's Black-Cockatoo	S2	EN	•	•		•			0.5 (2008), 117	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Calyptrorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S3	VU	•					•	1.9 (2000), 31	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Isoodon fusciventer</i>	Southern Brown Bandicoot	P4		•			•	•		0.9 (2008), 29	Foraging Breeding	Foraging Breeding	Foraging Breeding	Resident.	Occurs
<i>Phascogale tapoatafa wambenger</i>	Wambenger Brush-tailed Phascogale	S6		•						6.7 (2013), 35	Foraging Breeding			Requires multiple canopy strata.	Occurs
<i>Galaxiella nigrostriata</i>	Black-striped Dwarf Galaxias, Black-stripe Minnow	S2	EN							0.4 (2018)			Foraging Breeding	Ephemeral wetlands.	Occurs
<i>Hydromys chrysogaster</i>	Water-Rat	P4		•					•	4.7 (1953), 12				Requires significant drainage / waterbody with riparian cover.	Likely to occur
<i>Falco peregrinus</i>	Peregrine Falcon	S7		•					•	9.3 (2006), 2		Foraging		Potential foraging visitor. No breeding habitat available.	Likely to occur (foraging visitor)
<i>Ctenotus ora</i>	Coastal Plains Skink	P3		•						7.6 (1982), 2				Lack of species records precludes definitive assessment.	Possible
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle, Western Falsistrelle	P4		•						0.5 (2007), 3	Foraging Breeding			Roosts in tree hollows.	Possible
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		•						0 (1975), 19	Foraging			Rarely recorded on SCP; large woodland areas required to support a resident population. Possible visitor.	Possible
<i>Oxyura australis</i>	Blue-billed Duck	P4		•						5.9 (2002), 84			Foraging		Possible
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	S3	VU	•	•					0.4 (2004), 5	Foraging Breeding			Foraging visitor.	Possible (foraging visitor)
<i>Setonix brachyurus</i>	Quokka	S3	VU	•	•					0 (1976), 12	Foraging		Foraging	Prefers dense understorey with water nearby. Only one population recorded on the SCP.	Unlikely to occur
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	S1	EN	•						2.9 (2009), 1	Foraging Breeding				Unlikely to occur
<i>Numenius madagascariensis</i>	Eastern Curlew	S1; S5	CR, MI	•	•					8.6 (2015), 4					Unlikely to occur
<i>Botaurus poiciloptilus</i>	Australasian Bittern	S2	EN	•						2.6 (2011), 1					Unlikely to occur
<i>Calidris ferruginea</i>	Curlew Sandpiper	S1; S5	CR, MI	•	•					9.3 (2001), 1					Unlikely to occur
<i>Oxyura australis</i>	Blue-billed Duck	P4		•						5.9 (2002), 84			Foraging		Unlikely to occur
<i>Westralunio carteri</i>	Carter's Freshwater Mussel	S3	VU	•	•					8 (1905-2016)					Unlikely to occur

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5.1 Target Species

5.1.1 Western Ringtail Possum

The Western Ringtail Possum or Ngwayir (*Pseudocheirus occidentalis*) is listed as Critically Endangered under the BC Act, a classification that indicates that it is rare or is likely to become extinct as critically endangered fauna. The species is also listed as Critically Endangered under the EPBC Act and is thereby significant in a national context.

The Western Ringtail Possum is a medium-sized arboreal marsupial, endemic to south-western Western Australia. The species is exclusively folivorous, feeding on leaves of myrtaceous species, predominantly Peppermint, but also Marri and Jarrah. During the day, possums rest in tree hollows or dreys (nests constructed from vegetation, which are generally in the canopy but can occasionally be found at ground level). Home range size varies with the productivity of the habitat but is generally less than 5 ha, although densities of up to 20 individuals per hectare have been recorded in Peppermint woodland near Busselton (DPaW 2017a). Some populations breed throughout the year, but on the southern Swan Coastal Plain females give birth to one young (more rarely up to three) in autumn (April-June); these are weaned and independent at six to seven months (DPaW 2017a).

The species was once widely distributed across southern and south-western Western Australia but due to habitat clearing and fragmentation for agricultural and urban development, it is now restricted to three areas: the southern Swan Coastal Plain, the Jarrah forests near Manjimup and the south coast between Albany and Walpole (DPaW 2017a). Habitat loss and fragmentation continue to represent the major threat to the species, while other threats include predation by introduced carnivores, climate change, logging, fire and competition for nest hollows (DBCA 2017).

Likelihood of occurrence: The Western Ringtail Possum was recorded throughout the Proposal Area wherever woodland fragments or scattered habitat trees occurred.

5.1.2 Black-cockatoos

Three species of black-cockatoo in the south-west of Western Australia have documented breeding areas overlapping the Proposal Area, however it is only located in the typical breeding distribution of the Forest Red-tailed Black-cockatoo (Johnstone and Storr 1998, DSEWPaC 2012a). Black-cockatoos require tree hollows with suitable dimensions for nesting and breeding, which typically occur in larger trees over 200 years old (DSEWPaC 2012a). As such, breeding habitat trees are defined in the Commonwealth Referral guidelines as any tree with a DBH equal to or greater than 50 cm (DSEWPaC 2012a). Activities such as logging and deforestation for agriculture have contributed to a decline in abundance and range of black-cockatoos, hence their listing as conservation significant species.

5.1.2.1 Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black-Cockatoo is listed as Endangered under the BC Act and EPBC Act.

This species is distributed from Kalbarri to Esperance. During the breeding season, between July and November, they have been historically concentrated in the Wheatbelt region (Johnstone and Storr 1998, Saunders et al. 2014b) where they primarily nest in Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*). However, elsewhere the species are also known to nest in Tuart, Marri, Red Morrel (*E. longicornis*) and York Gum (*E. loxophleba*) (Johnstone and Storr 1998).

The Swan Coastal Plain has historically been more important as a foraging area than for breeding, with the birds moving into the area after breeding and occurring in the autumn and winter months. However, the species' breeding stronghold in the Wheatbelt has been moving onto the Swan Coastal Plain more recently (DSEWPaC 2012). Expansion in the breeding range further south and west towards the Jarrah - Marri forests of the Darling Scarp and Tuart forests of the Swan Coastal

Plain (including near Bunbury) has occurred in the past 10 to 30 years (Johnstone et al. 2010). Long-term studies show that Carnaby's Black-cockatoos utilise hollows ranging from 10 – 65 cm in diameter (average 26 cm) and approximately 130 cm deep (Saunders et al. 2014a, 2014b). They also frequent coastal areas outside of the breeding season where they forage in large flocks (Saunders et al. 2011), feeding on the seeds of *Banksia*, and *Eucalyptus* species such as Jarrah, Marri and Karri (*E. diversicolor*).

Likelihood of occurrence: Occurs; foraging evidence was recorded within the Proposal Area.

5.1.2.2 Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black-Cockatoo is listed as Endangered under the BC Act and EPBC Act.

The species occurs in the humid and subhumid areas of the southwest, distributed from Gidgegannup in the north to Naturaliste National Park and Augusta, also occurring in the Stirling and Porongurup Ranges and east along the south coast to Waychinicup (Johnstone and Storr 1998). Between March and September, the majority of the population migrates north from the cooler Karri forest to the central and northern Darling Range and eastern Swan Coastal Plain (Johnstone et al. 2010). They feed mainly on the seeds of Marri trees, as well as various species of *Banksia* and *Hakea* (Johnstone and Storr 1998).

Although the breeding requirements of this species are still poorly known, breeding has been recorded in the southwest north to Serpentine and east to Kojonup and Albany (Johnstone et al. 2010). Baudin's Black-Cockatoos nest mainly in hollows of Karri, Marri and Wandoo trees. Breeding typically occurs between March and October, but egg laying has also been reported less frequently in November and December (Johnstone and Storr 1998, Johnstone et al. 2010). Specific dimensions of hollows used for breeding have not previously been studied for Baudin's Black-Cockatoo, but they are likely to be similar to those hollows used by Carnaby's Black-Cockatoo.

Bunbury represents a known breeding area for Baudin's Black-cockatoo (DSEWPac 2012).

Likelihood of occurrence: Occurs; secondary feeding evidence was recorded in several locations from the distinct chew pattern on Marri nuts.

5.1.2.3 Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black-Cockatoo is listed as Vulnerable under the BC Act and EPBC Act.

This species occurs from Gingin in the north across to near Albany in the south (Johnstone and Storr 1998). It typically nests in Marri, Jarrah and Karri tree hollows with entrance diameters ranging from 12 – 150 cm (average 34 cm) and depths of 100 – 500 cm (average 144 cm) (Johnstone and Storr 1998, Johnstone et al. 2013). Females lay eggs between October and November and incubation is approximately 29 – 31 days, during which time the female stays with the egg and is fed by the male (Johnstone and Storr 1998). They feed mainly on Jarrah and Marri seeds but also Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Persoonia longifolia*) and Swan River Blackbutt (*E. patens*) (Johnstone et al. 2010).

Likelihood of occurrence: Occurs. Forest Red-tailed Black-Cockatoo were recorded adjacent to the Proposal Area by observation of feeding individuals, and within the Proposal Area secondarily via feeding evidence.

5.1.3 Wambenger Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)

The Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) is listed as Conservation Dependent Fauna under the BC Act.

Populations of the Brush-tailed Phascogale occur at the extreme coastal extents of Australia and are threatened across most of their range. The south-west population was described as a distinct subspecies in 2015 (Aplin et al. 2015) and is distributed between Perth and Albany. It occurs at low

densities in the northern Jarrah forest, with the highest densities occurring in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DBCA 2012).

The *wambenger* subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. Records from wetter forests are less common. Brush-tailed Phascogales are nocturnal arboreal carnivores that forage for food under the bark of trees (van Dyck and Strahan 2008). This feeding mode and the use of tree hollows for shelter results in a preference for large trees, particularly Jarrah and Marri with over 95 cm DBH (Rhind 1996).

Brush-tailed Phascogales are short-lived, with all males dying at the end of the breeding season and a small number of females living up to 2.5 years, long enough to produce a litter in their second year (Rhind and Bradley 2002). They maintain relatively large territories (over 20 ha) and female territories are exclusive; as a result, densities tend to be low.

Likelihood of occurrence: Occurs. Four Brush-tailed Phascogale individuals were recorded within the Proposal Area.

5.1.4 Chuditch (*Dasyurus geoffroii*)

The Chuditch (*Dasyurus geoffroii*) is listed as Vulnerable under the BC Act and EPBC Act.

Chuditch were previously known from most of Australia, occurring in every mainland state and territory. The species was relatively abundant until European settlement, when it underwent a drastic decline and range contraction. The species went extinct in New South Wales in the 1940s, Victoria in the 1950s and in Queensland between 1880 and 1910. It is now largely restricted to the southwest of Western Australia, with small numbers in the Midwest, Wheatbelt and South Coast regions where continuous forest or suitable fragments remain. Historically, Chuditch inhabited a wide range of habitats, but today this species predominantly occurs in Jarrah (*Eucalyptus marginata*) forest, wet and dry sclerophyll forest, and mallee remnants in Western Australia (Menkhorst and Knight 2011).

Chuditch are seasonal breeders, with mating occurring in late April – early July (Menkhorst and Knight 2011). Chuditch utilise hollow logs and burrows as dens or refuges, and occur in Eucalypt forests, dry woodlands and mallee shrublands (Strahan 1995).

The Chuditch faces a number of threats including predation and competition with the Red Fox and the Feral Cat, altered fire regimes, direct mortality as a result of road trauma, habitat loss and degradation (Morris et al. 2003).

Likelihood of Occurrence: Possible visitor. The Chuditch was not recorded within the Proposal Area or any contextual sites, despite intensive spotlighting effort over a period of two years. The Chuditch has been assessed as a 'Possible' occurrence within the Proposal Area. There are few records of the species in close proximity, with only four records between 1972 and 2012 ranging from 2.9-7.1 km away. While the Proposal Area does contain woodland habitat, the Chuditch would only be considered a potential visitor where vegetation within the Proposal Area is continuous with larger remnants outside the Proposal Area. Such examples include the small southern fringe where Manea Park occurs within the Proposal Area; and possibly where the study intersects with Bussell Highway, as Reserve 23000 occurs adjacent to the west, however the intervening Bussell Highway would represent a barrier to movement.

5.2 Non-target Species with Potential to Occur

5.2.1 Black-stripe Minnow, Black-striped Dwarf Galaxias (*Galaxiella nigrostriata*)

The Black-stripe Minnow is listed as Endangered under the BC Act and EPBC Act.

This small freshwater galaxiid fish is endemic to the southwest of Western Australia. The species aestivates in the sediments of seasonal wetlands when the wetlands dry over summer. Once thought to be more extensively distributed in coastal wetlands between Moore River and Albany, this species is now only found in three remnant populations on the Swan Coastal Plain and wetlands between Augusta and Albany (Galeotti et al. 2010).

Likelihood of occurrence: Occurs. This species was recorded from ephemeral wetland habitat continuous with the north of the Proposal Area (WRM 2019a).

5.2.2 Southern Brown Bandicoot, Quenda (*Isodon obesulus fusciventer*)

The Southern Brown Bandicoot is listed as a Priority 4 species by the DBCA (see DBCA 2018).

It is patchily distributed, occurring along the Swan Coastal Plain and in Jarrah and Karri forests from just north of Perth to east of Esperance. It occurs in habitats with sandy soil supporting dense vegetation in the lower stratum. Along the Swan Coastal Plain, the species is often associated with wetlands (van Dyck and Strahan 2008, van Dyck et al. 2013).

The Southern Brown Bandicoot is a medium-sized ground-dwelling marsupial that is territorial. Breeding in this species is opportunistic, beginning in winter and peaking in spring, and lasting 6 – 8 months. The species constructs a nest of ground litter over a shallow depression next to or under logs, shrubs or debris piles. It is mostly nocturnal, but is sometimes active during the day when it searches for invertebrates, fungi and subterranean plant material (van Dyck and Strahan 2008, van Dyck et al. 2013).

Likelihood of occurrence: Occurs; diggings of the Southern Brown Bandicoot were recorded within the Proposal Area. NatureMap records place the species in close proximity to the Proposal Area.

5.2.3 Water Rat (*Hydromys chrysogaster*)

The Water Rat or Rakali is listed as a Priority 4 species by the DBCA (see DBCA 2018).

The Water Rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh or brackish water habitats in the southwest of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands (Strahan 1995).

The Water Rat is an opportunistic predator, feeding on large aquatic insects, fish, crustaceans, mussels, frogs, lizards, small mammals, fresh carrion and water birds (van Dyck and Strahan 2008). The Water Rat is not entirely nocturnal; it is most active around sunset but may forage during the day. Breeding occurs throughout the year, but most young are born between spring and late summer (van Dyck and Strahan 2008).

The Water Rat faces predation by the Feral Cat (*Felis catus*) and the European Red Fox (*Vulpes vulpes*), and as such faces the threat of population decline via direct mortality. Swamp reduction and flood mitigation have also removed habitat, and salinity and degradation of waterways have caused significant declines in southwest populations (van Dyck and Strahan 2008).

Likelihood of occurrence: The Water Rat is considered 'Likely to Occur' although only in isolated areas due to the relatively small and ephemeral nature of watered habitat within the Proposal Area. This assessment is supported by the results of an aquatic survey over much of the Proposal Area by WRM (2019b) where a single Water Rat midden was recorded.

5.2.4 Western False Pipistrelle (*Falsistrellus mackenziei*)

This bat is listed as a Priority 4 species by the DBCA (see DBCA 2018).

This species is restricted to the south-western corner of Western Australia and has not been seen in the northern part of its range (north of Collie in the Jarrah forest, north of Mandurah on the Swan Coastal Plain) since 1993 (Armstrong et al. 2017). It occurs in high rainfall areas dominated by Jarrah, Karri, Marri and Tuart. It prefers tall mature forest, but has also been recorded from Banksia woodland on the Swan Coastal Plain (Armstrong et al. 2017). This species forages under the tree canopy and along forest tracks, and roosts within tree hollows and fallen hollow logs. No information on the breeding biology of this species is available (Armstrong et al. 2017).

The Western False Pipistrelle faces multiple threats, including habitat loss as a result of logging, burning and clearing, as well as competition for resources from introduced species such as the European Honey Bee and Rainbow Lorikeet (Armstrong et al. 2017).

Likelihood of occurrence: Possible. In recent years, the species has been recorded from near Stratham and Australind. Where woodland habitat in the Proposal Area is continuous with larger areas outside, it is possible that this species may occur.

5.2.5 Western Brush Wallaby (*Notamacropus irma*)

The Western Brush Wallaby is listed as a Priority 4 species by the DBCA (see DBCA 2018).

This species is endemic to the south-west of Western Australia, where it is distributed from north of Kalbarri to near Cape Arid. It inhabits a wide range of habitats, including open forest and woodland, mallee, heathland, low open grasslands and thickets (Woinarksi and Burbidge 2016). It is absent from Karri forests with dense undergrowth.

Breeding occurs between April and May, with young emerging from the pouch from October to November. Historically, population declines were caused by poachers trading skins, the introduction of the fox and clearing of habitat for agriculture. Foxes are still a threat to the survival of this species, with juveniles most at risk of predation.

Likelihood of occurrence: Possible visitor. The Western Brush Wallaby is not commonly recorded in the Bunbury area (based on NatureMap records); the most recent record for the species, almost 5 km from the Proposal Area, was in 2015. However, given the availability of woodland habitat within the Proposal Area, this species has been assessed as a 'Possible' occurrence.

5.2.6 Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act.

The Peregrine Falcon has an almost cosmopolitan distribution across Australia, but is absent from most deserts and the Nullarbor Plain (Johnstone and Storr 1998).

This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country (Pizzey and Knight 2007). The Peregrine Falcon, like other birds of prey, is a relatively long-lived species, with low reproductive rates and low population density. These factors, combined with the fact that they are a top-end predator and limited by their prey, make them particularly vulnerable to human impact.

Likelihood of occurrence: Likely as a foraging visitor. Although the Proposal Area lacks the preferred nesting habitat for the species, it is possible it would forage within it at times.

5.2.7 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as a Priority 4 species by DBCA (see DBCA 2018).

In Western Australia, the Blue-billed duck occurs predominantly in the southwest, with their range extending from Lake Pinjarrega in the north and east across to Esperance (Johnstone and Storr

1998). They are almost exclusively aquatic, with preferred habitat including deep freshwater swamps or lakes and occasionally saltwater lakes or estuaries inundated with fresh water. Breeding occurs from early August to the end of March; nests are made from trampled bulrushes 10–30 cm above water (Johnstone and Storr 1998).

Likelihood of occurrence: Possible visitor. The species has been recorded commonly on the Leschenault Inlet and Collie River. Although no core habitat for the species is present in the Proposal Area, it may occasionally occur within it when the ephemeral wetland areas support water.

5.2.8 Coastal Plains Skink (*Ctenotus ora*)

The Coastal Plains Skink is listed as a Priority 3 species by the DBCA (see DBCA 2018).

This species is relatively newly described, having been grouped with *Ctenotus labillardieri* prior to 2012 (Kay and Keogh 2012). Records of the species are sparse but it is described as inhabiting open eucalypt woodland over banksia, and low vegetation on sandy coastal plains and dunes.

Likelihood of occurrence: Possible. Records of the skink have been largely coastal to date but include one record from Eaton. Given the paucity of data, a conservative approach has been taken and this species is considered as a possible resident.

5.3 Conservation Significant Species that are Unlikely to Occur

The following species were returned from database searches but are considered unlikely to occur in the Proposal Area based on habitat preference and known distributions.

5.3.1 Woylie, Brush-tailed Bettong (*Bettongia penicillata ogilbyi*)

The Woylie is listed as Critically Endangered under the BC Act and Endangered under the EPBC Act.

Once very common and distributed over much of Australia, the species suffered severe decline following European colonisation and the introduction of feral predators. This medium weight range marsupial is nocturnal and forages primarily for native fungi.

Likelihood of occurrence: Unlikely to occur. One record of the Woylie was returned from the NatureMap database, however the species is now known to have a distribution restricted to two small areas (the Upper Warren and Dryandra Woodland). Translocated populations occur at Batalling and inside fenced areas in Mt Gibson, Karakamia and Whiteman Park.

5.3.2 Quokka (*Setonix brachyurus*)

The Quokka is listed as Vulnerable the BC Act and EPBC Act.

The Quokka occurs in isolated populations on Rottnest Island, Bald Island and fragmented areas of the mainland between the Hunter Valley and Jarrah forests south of Perth. The Quokka has specific habitat requirements, preferring dense understorey vegetation or a complex vegetation structure (comprising at least three layers) that provides ample protection from predators. The Quokka also requires water to be nearby and is often found in swampy or riparian areas. Critical habitat in both the northern and southern extent of its range is described as patches of varying fire age, with some areas more recently burnt. This may reflect their preference to feed on new growth vegetation in recently burnt areas.

Historically, disease and the introduction of the Red Fox have been responsible for major population declines. Current threats include uncontrolled fox populations and loss of habitat through inappropriate fire regimes. The Quokka is also indirectly affected by dieback disease, which has the potential to severely alter vegetation structure.

Likelihood of occurrence: Unlikely to occur. The nearest record of the species is from swampland near Stratham (<5 km from the Proposal Area), however this represents the only known remaining population on the Swan Coastal Plain and appears to be restricted to that particular swamp.

5.3.3 Australasian Bittern (*Botaurus poiciloptilus*)

The Australasian Bittern is listed as Endangered under the BC Act and EPBC Act.

The Australasian Bittern is a relatively large bittern with streaked brown and buff plumage. It is secretive and well camouflaged in dense vegetation. It occurs in swamps with tall dense vegetation, especially reeds, rushes and sedges (Menkhorst et al. 2017). In Western Australia, it is primarily found in the deep south-west.

Likelihood of occurrence: Unlikely to occur. The Proposal Area is generally devoid of the species' preferred habitat, which includes significant reed beds to provide cover and nest within.

5.3.4 Curlew Sandpiper (*Calidris ferruginea*) and Eastern Curlew (*Numenius madagascariensis*)

Both the Curlew Sandpiper and Eastern Curlew are listed as Critically Endangered and Migratory under both the BC Act and EPBC Act.

These small shorebirds are general found in large flocks on intertidal mudflats in sheltered coastal areas and less frequently on inland freshwater wetlands (Geering et al. 2007).

Likelihood of occurrence: Unlikely to occur. Both species have been recorded along the Bunbury coast north to Australind, but there are few inland records. These waders may occur as occasional visitors to better watered areas of the Proposal Area, but no core (intertidal) habitat is present within the Proposal Area.

5.3.5 Carter's Freshwater Mussel (*Westralunio carter*)

Carter's Freshwater Mussel is listed as Vulnerable under the BC Act and the EPBC Act.

The only freshwater mussel in south-west Western Australia, Carter's Freshwater Mussel was added to both State and Federal conservation listings in 2018 following recognition of its declining distribution, thought to be primarily caused by increasing salinity and drying of its habitat. Comparing historical and current records indicates that the species is likely to have undergone a 49% reduction in its distribution in three generations (Klunzinger et al. 2015). Once distributed from Moore River in the north to King George Sound in the south and inland to the Avon River, the species now only occurs within freshwater streams, rivers, reservoirs and lakes within 50 – 100 km of the coast, from Gingin Brook southward to the Kent River, Goodga River and Waychinicup River. Locally, Carters Freshwater Mussel occurs in the Preston River and a tributary of the Collie River, north of the Proposal Area (Biota 2019a, WRM 2019a).

The life-history of the species contributes to its vulnerability, with an age at sexual maturity of 3–6 years and complex maturation stages, including a parasitic larval stage where glochidia must attach to the gills of host fish (Klunzinger et al. 2014).

The species is patchily distributed in sandy/muddy sediments of freshwater lakes, rivers and streams, with greatest densities associated with exposed submerged tree roots of Flooded Gums (*Eucalyptus rudis*), *Melaleuca* spp. and others, woody debris, and overhanging riparian vegetation near stream banks and edges of lakes/dams. Precise habitat requirements and quantification within habitat types are in the early stages of study for this species. Juveniles may require specific micro-habitats and are difficult to locate in the wild.

Likelihood of occurrence: Unlikely to occur. This assessment is supported by the results of an aquatic survey within the Proposal Area by WRM (2019b) where despite extensive survey effort at six sites, the species was not recorded. It was concluded in that study that they mussel was not recorded due to the highly ephemeral nature of the wetlands within the Proposal Area.

6.0 Discussion

6.1 Western Ringtail Possum

The abundance of Western Ringtail Possums recorded in the Proposal Area during the four phases of strip-sampling ranged from 53 to 79 with an average of 68.75. This abundance within the 199.73 ha Proposal Area yields an average density of 0.35 individuals per hectare. This near comprehensive sampling technique affords a high level of confidence in abundance estimates, although it likely represents a slight underestimate of the total number of individuals due to both a small number of possibly undetected individuals and the effect of access restrictions (see Figure 4.3).

Recent surveying for Western Ringtail Possums at both the local scale (Biota in prep., 2018c, 2018d, 2018e) and regional scale (Biota and Analytical Edge 2019b) allows for the potential impact to Western Ringtail Possums occurring within the Proposal Area to be placed in context.

6.1.1 Local Context

It is possible to provide a broad estimate of Western Ringtail Possum presence and abundance in the local area using a combination of sampling at local sites together with the habitat mapping of Shedley and Williams (2014). The report of Shedley and Williams (2014) provides broad-scale habitat suitability mapping for the Western Ringtail Possum over the southern Swan Coastal Plain from Binningup to Dunsborough. The mapping is based on a combination of existing landscape scale thematic layers tested against known abundances of Western Ringtail Possums, where these data were available. The factors found to be most important in predicting Western Ringtail Possum presence included habitat quality derived from soil and vegetation attributes, presence and dominance of Peppermint, area of patch, area of other habitat within its neighbourhood and distance to the nearest other high quality patch. The suitability mapping within and surrounding the Proposal Area is shown in Figure 6.1.

This habitat mapping is qualitative due to its reliance on existing thematic layers (i.e. it is not ground-truthed) and aims to highlight areas of habitat most important to the persistence of the Western Ringtail Possum on the southern Swan Coastal Plain. The reliance on existing thematic layers means that, at the scale of Proposal Area, gaps of unmapped habitat appear and as such it should be considered underestimate of the total habitat available. This mapping qualitatively describes 81.19 ha of vegetation within the Proposal Area of which the majority was designated medium suitability (65.14 ha), while a portion of the Jilley Road to Bussell Highway section was described as high suitability (11.87 ha), the remainder was described as low (3.50 ha) or very low (0.31 ha) suitability. None of the Proposal Area was defined as very high suitability in the Shedley and Williams (2014) mapping.

We have sought to calculate a broad estimate of Western Ringtail Possum local abundance within the context area shown in Figure 6.1, comprising 10,935 ha. This context area has been drawn to avoid metropolitan Bunbury and include the five relatively large context sites (ranging from 40.5 ha to 216.2 ha) for which we have robust abundance estimates; Lot 1 Ducane Road, Shire of Capel Reserve 23000, Lot 2 Boyanup Picton Road (i.e. the Reference Site), Manea Park, Lots 266 – 268 Ducane Road and various lots near Boyanup-West Road in the vicinity of Stratham, collectively referred to as the Southern Lots (Figure 6.1). Biota has carried out Distance sampling at all five of these context sites and additional comprehensive strip-sampling at two of them (Reserve 23000 and the Reference Site: Lot 2 Boyanup Picton Road). The full methods and results relating to these context sites has been reported separately (Biota 2019, Biota and Analytical Edge 2019). The distance sampling estimates presented here were current at the time of reporting but have potential to alter slightly in future, as further surveys improve statistical modelling. The full methods and results relating to this context work have been reported separately (Biota 2018d, 2019b). The locations of the context sites in relation to the Proposal Area are shown in Figure 6.1.

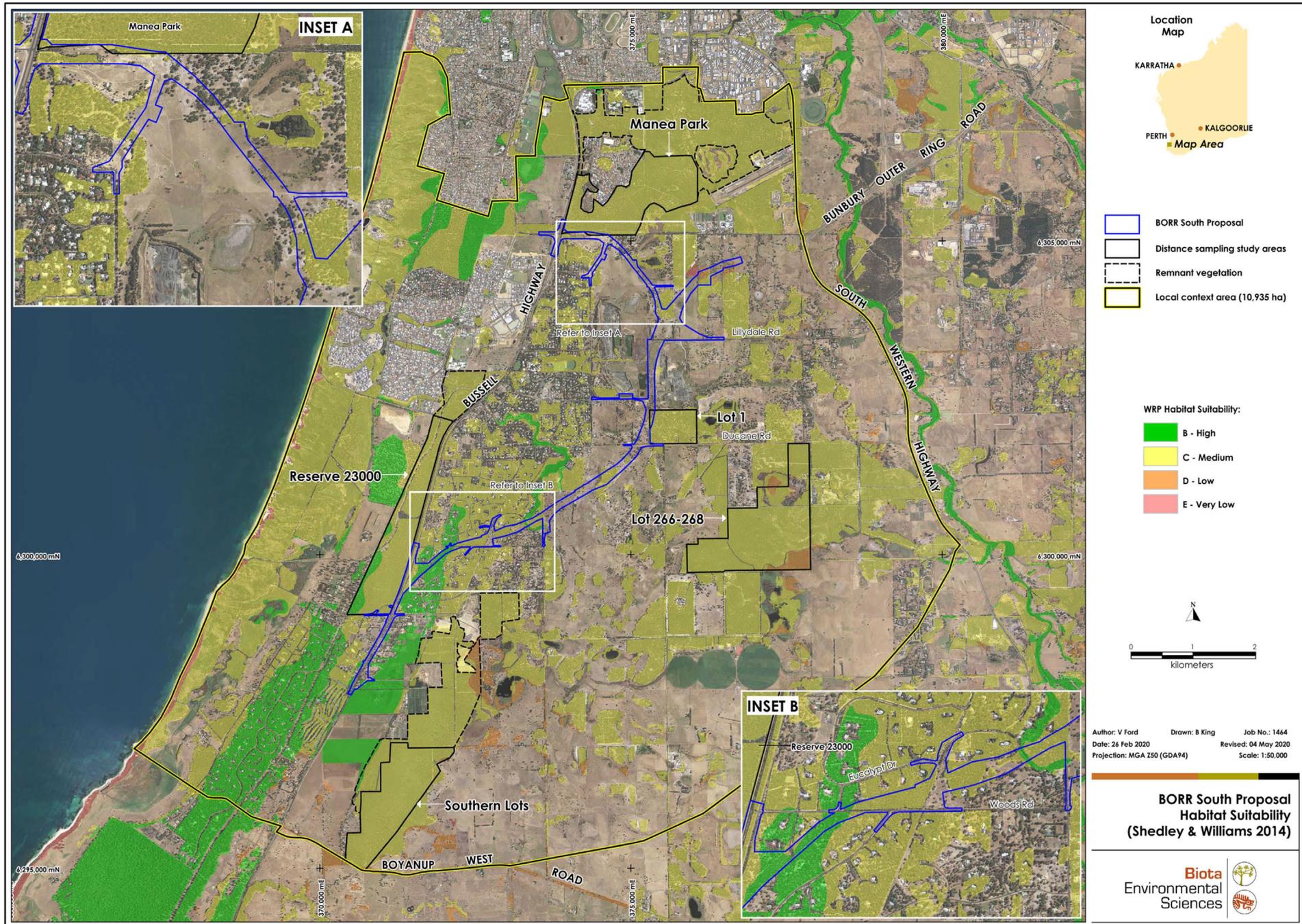


Figure 6.1: The Proposal Area and context sites within the local context area showing habitat suitability (Shedley and Williams 2014).

The estimated abundance of the Western Ringtail Possum within the Proposal Area and each context site is given in Table 6.1. Four phases of strip-sampling within the Proposal Area yielded an average abundance of 68.75 Western Ringtail Possum individuals. At the context sites a total abundance of 706 individuals was estimated, using the average abundance from sites that have been sampled on multiple occasions and using the strip-sampling result from within the Proposal Area, Reference Site and Reserve 23000 (Figure 6.1).

For some of the context sites, the surveyed area represented a subsample of a larger area of contiguous habitat, the most notable examples being Manea Park and Southern Lots. The surveyed area of Manea Park (155 ha) represented approximately 30% of the total extent of the contiguous remnant patch, which extends further to the east and north and encompasses 258 ha of apparently similar habitat (based on aerial imagery). If this area supported a comparable density to the surveyed section (1.23 individuals per hectare), it would yield a further 310 Western Ringtail Possums. The total number of Western Ringtail Possums in this single remnant would then be estimated at 508. The surveyed area of the Southern Lots (188 ha) was calculated to have a Western Ringtail Possum density of 0.42 ± 0.1 per ha which if applied to the 211 ha of additional habitat north and west beyond the area sampled would support an additional 88 possums. This would take the total estimate to approximately 168 for the contiguous remnant (approximately 359.72 ha in size). The same process may be applied to Reserve 23000 where strip-sampling produced an average density estimate of 1.14 individuals per ha. If this estimate was applied to the 40 ha remnant to the north of Harewood Road, a further 46 individuals were estimated to occur in the broader remnant patch increasing the total to 204 for the entire area. In this manner, the total number of Western Ringtail Possums increases from 706 to 1069 ha if density estimates were extrapolated into contiguous (or nearly so) sections of the surveyed remnants.

Interpolating to the 10,935 ha local context area, 4,818.1 ha has been mapped as Western Ringtail Possum habitat by Shedley and Williams (2014). Of this, 173.6 ha has been mapped as low to very low suitability and as such has been removed from consideration, giving a total of 4,644.5 ha of medium to high quality habitat. Of this 4,644.5 ha of habitat, 821.19 ha (18%) has been sampled within the Proposal Area (75.39 ha) in combination with regional context sampling (745.8 ha) (Biota and Analytical Edge 2019b). Within this sampled area a total abundance of 637.07 individuals has been estimated, using the average abundance from sites that have been sampled on multiple occasions and using the strip-sampling result from within the Proposal Area and Reference Site. Extrapolating the average density of individuals within the surveyed areas (0.78 individuals per hectare) over the remainder of the local context area habitat results in an estimate of 3,603.13 individual Western Ringtail Possums in the local context area.

In summary, the above provides local context for the 53 - 79 Western Ringtail Possums within the Proposal Area by providing estimates at three scales. Initially, within surveyed areas of the contextual sites where an abundance of 706 individuals was estimated, secondly by interpolating to immediately adjacent and contiguous habitat to yield an estimate of 1069. Finally, we extend to the local context area utilising the Shedley and Williams (2014) habitat mapping and estimate a population of over 3,603.

Table 6.1: Results of Western Ringtail Possum sampling within the Proposal Area, Reference Site and local context sites within 5 km.

Location	Area (ha)	Method	Date	Observations (Individuals)	Density (individuals per ha)	Abundance
Proposal Area						
Proposal Area	199.73	Strip-sampling	August 2019	42 (54)	0.27	53
			October 2019	58 (76)	0.38	76
			December 2019	61 (79)	0.40	79
			February 2020	54 (67)	0.34	67
Reference Site						
Reserve 23000 Shire of Capel	146.1	Strip-sampling	November 2019	123 (165)	1.13	165
			December 2019	138 (175)	1.20	175
			February 2020	118 (136)	1.09	136
Context Sites						
Reserve 23000 Shire of Capel	146.1	Distance Sampling	February 2018	56 (75)	1.03 ± 0.21	150.81 ± 30.41
			August 2018	46 (60)	0.56 ± 0.11	81.61 ± 15.85
Manea Park	155.0	Distance Sampling	October 2018	74 (103)	1.23 ± 0.23	190.83 ± 35.34
Lot 266 -268 Ducane Road	216.2	Distance Sampling	July 2019	45 (55)	0.65 ± 0.12	126.37 ± 22.63
Southern Lots	188	Distance Sampling	November 2018	25 (33)	0.42 ± 0.10	79.65 ± 19.47
Lot 1 Ducane Road	40.5	Distance Sampling	February 2018	7 (8)	0.21 ± 0.12	8.53 ± 4.64
			July 2018	8 (10)	0.47 ± 0.27	19.20 ± 11.06
			August 2018	5 (6)	0.26 ± 0.16	10.67 ± 6.47

6.1.2 Regional (Swan Coastal Plain) Contextual Scale

For the purpose of defining this scale, we have adopted the boundary of the Swan Coastal Plain (sub-region SWA02) as defined by the Interim Biogeographic Regionalisation of Australia (DSEWPaC 2012b). This sub-region largely coincides with the area of interest considered by Shedley and Williams (2014) but extends further north (Myalup was the northern extent of the Shedley and Williams (2014) mapping) to encompass the population in the Yalgorup National Park. Western Ringtail Possum are not known on the Swan Coastal Plain from north of the Dawesville Channel.

The mapped occurrence of Western Ringtail Possum habitat (south of Myalup; Shedley and Williams 2014) encompassed by the Swan Coastal Plain IBRA region totals 354 km². Within this same region, Biota sampled approximately 35 km² (10%) of the mapped habitat using a line-transect distance sampling approach. A further 12 km² of habitat was surveyed in Yalgorup National Park.

The line-transect distance sampling estimated abundance for the surveyed region is $6,445 \pm 311$ (95% confidence interval: 5,864 – 7,088). The overall abundance within the entire Swan Coastal Plain bioregion will be higher, given that approximately 90% of mapped habitat remains unsurveyed. However, the line-transect distance sampling program did sample most of the very high quality habitat on the Swan Coastal Plain, and much of the remaining habitat would likely support much lower densities than those that contributed to the regional estimate.

The population estimate of 2,000 individuals for the Swan Coastal Plain cited in the IUCN assessment (Burbidge and Zichy-Woinarski 2017) was for the adult population, whereas the above estimate (of $6,445 \pm 311$) is for all individuals, including young with their mothers. A second estimate which collapses all detections of multiple individuals to a single observation (thereby excluding young, but also some adults), yielded an estimate of $4,938 \pm 235$ individuals, which is still two and a half times the IUCN estimate.

6.1.3 Estimated Extent of Occupation Contextual Scale

The largest scale of contextual consideration represents the Estimated Extent of Occupation (EEO) for the species, spanning Yalgorup National Park to Albany and encompassing the Swan Coastal Plain, Jarrah Forest and Warren IBRA regions. Within the EEO, surveys using a distance sampling approach to estimate abundance were conducted at 40 locations encompassing a combined area of over 1,050 km² (Biota in prep.), representing 3% of the EEO (40,000 km²) reported in the IUCN assessment of the species (Burbidge and Zichy-Woinarski 2017) (Table 6.2).

Sites surveyed by that regional distance sampling program broadly fell within the regions encompassing the sub-populations identified in the IUCN assessment (Burbidge and Zichy-Woinarski 2017), namely the Swan Coastal Plain, Cape to Cape, Upper Warren and Around Albany (the Inland Rivers sub-population was not surveyed). The derived population estimates for each of these regions are presented in Table 6.2.

The 2014 population estimates were obtained by expert elicitation and are for the adult population across the entire EEO for the Western Ringtail Possum. The 2019 population estimates are derived from a robust distance sampling program conducted across 40 locations and estimate all individuals (adults and young) but only within the combined extent of the surveyed area (i.e. 1,050 km²). The distance program spanned seven months (between January 2019 and August 2019), traversed over 1,100 km of transects and directly observed 3,604 individual Western Ringtail Possums.

Table 6.2: Population estimates of Western Ringtail Possum derived from IUCN expert elicitation in 2014 (Burbidge and Zichy-Woinarski 2017) and a 2019 regional population assessment using line transect distance sampling (Biota in prep.).

IUCN Assessment Sub-population	2014 IUCN Population Estimate (adults)	2019 Distance Sampling Estimate (95% confidence interval) (all individuals)
Swan Coastal Plain	2,000	6,445 ± 311 (5,864 – 7,088)
Cape to Cape	500	2,263 ± 186 (1924 – 2661)
Upper Warren	100	7,680 ± 1,774 (4,891 – 12,059)
Other Manjimup Sites	Not assessed	Approx. 250
Around Albany	500	3,045 ± 208 (2,663 – 3,482)
Other Forest Rivers	300	Not assessed
Crooked Brook	Not assessed	721 ± 130 (506 – 1,028)
Total	3,400 (40,000 km²) *	20,404 (1,050 km²)**

* 2014 population estimate (adult population) obtained by expert elicitation for the entire Expected Extent of Occupation, equal to 40,000 km².

** 2019 population estimate (all individuals) for the surveyed area of 1,050 km² and derived from a robust distance sampling program.

6.2 Black-cockatoos

The field survey recorded evidence of all three species of black-cockatoo utilising the Proposal Area for foraging purposes, although no evidence of night roosting was recorded. Areas dominated by *Eucalyptus* spp. and Marri were considered foraging habitat; in some instances, this habitat also included lower strata dominated by *Banksia* spp. Only the small areas comprising uniform stands of *Melaleuca* shrubs and Peppermint woodland were considered unlikely to contain foraging or breeding habitat.

The Proposal Area was assessed as containing 65.37 ha of potential foraging habitat comprising 43.71 ha of high quality foraging habitat in form of Marri/*Eucalyptus* woodland while an additional 21.66 ha of Marri/*Eucalyptus* in paddocks and road reserves was assessed as moderate quality foraging habitat.

The known breeding distribution of all three species of black-cockatoos includes the area south of Bunbury as presented in the EPBC Act referral guidelines (DSEWPaC 2012a). Eucalypt woodland habitat dominated the Proposal Area and a total of 1,109 individual trees met the >50 cm DBH criteria for a potential breeding habitat tree (that is, a tree of a size with potential to form a suitable hollow). Of these 1,109 trees, using photographs from a RPA, five trees have been assessed as supporting hollows potentially suitable for black-cockatoo nesting, although no conclusive evidence of nesting was recorded.

7.0 Glossary and Acronyms

BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i> .
Biota	Biota Environmental Sciences.
BORR	Bunbury Outer Ring Road.
Black-cockatoos	Refers to all three species of black-cockatoo endemic to the south-west of Western Australia: Carnaby's Black-Cockatoo, Baudin's Black-Cockatoo and Forest Red-tailed Black-Cockatoo.
Breeding habitat (black-cockatoo)	Defined in the DSEWPaC (2012) referral guidelines as species of trees known to support breeding within the range of the species, which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 50 cm; for Salmon Gum and Wandoo, suitable DBH is 30 cm.
Conservation significant	Defined as those species listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> , the WA <i>Biodiversity Conservation Act 2016</i> or Department of Biodiversity, Conservation and Attractions Priority species list.
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions (formerly the Department of Environment and Conservation).
DBH	Diameter at breast height (approximately 1.3 m from base).
DotEE	The then Federal Department of Environment and Energy (now Department of Agriculture, Water and the Environment).
DSEWPaC	The then Federal Department of Sustainability, Environment, Water, Population and Communities (now Department of Agriculture, Water and the Environment).
EPA	Environmental Protection Authority, Western Australia.
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Foraging habitat (black-cockatoo)	Defined in the DSEWPaC (2012) EPBC Act referral guidelines as plants of species known to support foraging within the range of each of the species.
Known nesting trees (black-cockatoo)	Any existing tree in which breeding has been recorded or suspected (e.g. showing evidence of use through scratches or feathers).
Proposal Area	The BORR Southern Section Proposal Area.
Roosting habitat (black-cockatoo)	Defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the species.
RPA	Remotely-piloted aircraft.
Reference Site	Refers to Shire of Capel Reserve 23000, which has been systematically surveyed for Western Ringtail Possums in parallel with the Proposal Area on three occasions.
SCP	Swan Coastal Plain.
Brush-tailed Phascogale	Wambenger Brush-tailed Phascogale, <i>Phascogale tapoatafa wambenger</i> .

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8.0 References

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Appendix 1

Statutory Framework



Commonwealth *EPBC Act 1999*

Fauna species of national environmental significance are listed under the Commonwealth *EPBC Act*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk', which are consistent with IUCN categories.

Critically Endangered (CR): a taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN): a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU): a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Lower Risk (LR): a taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (CD).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (NT).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (LC).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

Migratory species are also protected under the *EPBC Act* as species of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. The list of migratory species consists of those species listed under the following international conventions:

1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
2. China-Australia Migratory Bird Agreement (CAMBA);
3. Japan-Australia Migratory Bird Agreement (JAMBA); and,
4. Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Marine species are also protected under the *EPBC Act*, and are listed to ensure the long-term conservation of the species. Marine species include all Australian sea snakes, seals, crocodiles, dugongs, marine turtles, seahorses and seabirds that naturally occur in the Commonwealth marine area.

Western Australian *Biodiversity Conservation Act 2016*

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 has been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016:

Threatened Species

- **Critically Endangered (CR):** Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines.
- **Endangered (EN):** Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.
- **Vulnerable (VU):** Threatened species considered to be “facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines”.

Extinct Species

- **Extinct Species (EX):** Species where “there is no reasonable doubt that the last member of the species has died”
- **Extinct in the wild (EW):** Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”

Specially Protected Species

- **Migratory (MI):** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth. Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program
- **Species of special conservation interest (conservation dependent fauna) (CD):** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
- **Other specially protected fauna (OS):** Fauna otherwise in need of special protection to ensure their conservation

Department of Biodiversity, Conservation and Attractions Priority Listing

The DBCA maintains a list of Priority species that have not been assigned statutory protection under the *Biodiversity Conservation Act 2016*. Species on this list are considered to be of conservation priority because there is insufficient information to make an assessment of their conservation status or they are considered to be rare but not threatened and are in need of monitoring. Under this list, species are classified according to four Priority categories:

Priority 1: Poorly known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

Priority 2: Poorly known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Priority 3: Poorly known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 2

DBCA Regulation Licences





Wildlife Conservation Act 1950

REGULATION 17

Regulation 17 – Licence to take fauna for scientific purposes (Regulation 17 - Standard)

The undermentioned person may take fauna for research or other scientific purposes and where authorised, keep it in captivity, subject to the following and attached conditions, which may be added to, suspended or otherwise varied as considered fit.

Director General

Conditions

- 1 The licensee must comply with the provisions of the Wildlife Conservation Act 1950, Wildlife Conservation Regulations 1970 and any Notices in force under this legislation.
- 2 The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.
- 3 Unless specifically authorised in the conditions of this Licence or otherwise in writing by the Director General, species of fauna declared as likely to become extinct, rare or otherwise in need of special protection shall not be taken.
- 4 Any by-catch of fauna, which is declared to be rare, likely to become extinct, or otherwise in need of special protection shall be released immediately at the point of capture. Where such fauna taken under this licence is injured or deceased, the licensee shall contact the Department's Wildlife Licensing Section for advice on disposal. Records must be kept of any such fauna so captured and details are to be included in the report required under further condition below.
- 5 Any interaction involving Gazetted Threatened Fauna that may be harmful to the fauna and/or invasive may require approval from the Commonwealth Department of the Environment ph 02 6274 1111. Interaction with such species is controlled by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the Wildlife Conservation Act 1950 and Wildlife Conservation Regulations 1970.
- 6 No fauna shall be taken in areas where it would impinge on pre-existing scientific research programs.
- 7 Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers used, and signs and structures erected by the licensee shall be removed and the environment returned to its original condition.
- 8 Not more than ten specimens of any one protected species of fauna shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.
- 9 The licensee shall not release any fauna or their progeny in any area where it does not naturally occur, nor hand such fauna over to any other person or authority unless approved by the Director General, nor dispose of the remains of such fauna in any manner likely to confuse the natural or present day distribution of the species.
- 10 Bioprospecting involving the removal of sample aquatic and terrestrial organisms for chemical extraction and bioactivity screening shall not be conducted without specific written approval by the Director General.
- 11 No fauna is to be taken from any CALM land, as defined in the Conservation and Land Management Regulations 2002, without prior written approval of the Director General. No fauna is to be taken from any public land without the prior written approval of the Government Authority managing that land.
- 12 The licensee must not enter upon any private property or pastoral lease for the purposes of this licence, nor take any fauna from any private land or pastoral lease without the prior consent in writing of the owner or occupier. Similarly, in the case of Aboriginal lands, the licensee must not enter upon or take fauna from such lands without the written approval of the Department of Aboriginal Affairs and/or the relevant native title holders or applicants.
- 13 Copies of this licence and any written approval or consent required by conditions of this licence must be carried by the licensee and any person/s authorised under the licence at all times when conducting activities relevant to the licence

DEPARTMENT OF PARKS AND WILDLIFE



Department of
Parks and Wildlife



Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9219 9000
Facsimile: 08 9219 8242
Web Site: <https://wildlifelicensing.dpaw.wa.gov.au>
Correspondance: **Locked Bag 30**
Bentley Delivery Centre WA 6983

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and must be presented to an authorised officer of the Department upon request.

- 14 All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range shall upon request be donated to the Western Australian Museum.
- 15 To prevent any unnecessary collecting in this State, all specimens and material taken and retained under the authority of this license shall, upon request, be loaned to the Western Australian Museum. Any unused portion or portions of any specimen collected under the authority of this license shall be offered to the Western Australian Museum for inclusion in its collection or made available to other scientific workers if so required.
- 16 Within one month of the expiration of this licence, the holder shall submit an electronic return into the department's Wildlife Licensing System, detailing the locality, site, geocode, date and number of each species of fauna captured, sighted or vouchered during the currency of the licence. A copy of any paper, report or thesis resulting from the research shall upon completion be lodged with the Director General.

Purpose

Bunbury Outer Ring Road Alternate Alignments Fauna Assessment for Main Roads WA, targeting conservation significant species, including but not limited to; western ringtail possum (*Pseudocheirus occidentalis*), Carnaby's cockatoo (*Calyptorhynchus latirostris*), Baudin's cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), south-western brush-tailed Phascogale (*Phascogale tapoatafa wambenger*), Chuditch (*Dasyurus geoffroii*) and Carter's Freshwater Mussel (*Westralunio carteri*). Fauna surveys by spotlighting / head torching, aural survey, secondary evidence and habitat assessment, and using camera traps, bat detectors, cage traps and Elliott traps. Captured fauna will have morphometrics and physical condition details recorded prior to release at capture site.
Location:

Locations

Bunbury Outer Ring Road Alternate Alignments project area; within City of Bunbury, Shire of Capel and Shire of Dardanup.

Authorised Person

Surname	Given name(s)
Teale	Roy
Ford	Stewart
King	Jacinta
Graff	John
Greenham	Michael
Brooshooft	Penny
Joshua	Keen
Priddle	Shane
King	Brandon

DEPARTMENT OF PARKS AND WILDLIFE



Department of
Parks and Wildlife



Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
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Date of Issue 24/10/2018
Valid From 24/10/2018
Date of Expiry 31/12/2018

Licensee: Dr Victoria Anne Cartledge
Address Biota Environmental Sciences
12 Bates Road
Innaloo WA 6018
Australia

Issued by a Wildlife Licensing Officer of the Department of Parks and Wildlife under delegation from the Minister for Environment pursuant to section 133(1) of the Conservation and Land Management Act 1984.



FAUNA TAKING (BIOLOGICAL ASSESSMENT) LICENCE

Regulation 27, Biodiversity Conservation Regulations 2018

Licence Number: BA27000005-3

Licence Holder: Ms Jacinta Phillipa King
Biota Environmental Sciences
Level 1, 228 Carr Place
Leederville WA 6007

Date of Amended: 18/04/2019

Date Valid From: 15/02/2019

Date of Expiry: 14/02/2020

LICENSED ACTIVITIES

Subject to the terms and conditions on this licence, the licence holder may –

1. Targeted fauna survey for Western Ringtail Possums (*Pseudocheirus occidentalis*) by undertaking a distance sampling program using transects and night vision goggles, to estimate the density of the possums in the designated sections of the Bunbury Outer Ring Road and reserve; and conduct a habitat assessment of three nearby bushland areas, for Main Roads WA. (a).

LOCATIONS

1. Bunbury Outer Ring Road section from Boyanup-Picton Road, Picton West / Dardanup West, south-west to Bussell Highway / Woods Road, Gelorup; and Shire of Capel Crown Reserve 23000 Dalyellup, 337 Ducane Road (LOT 1 ON DIAGRAM 42706), North Boyanup, and Lot 2 (ON PLAN 401654) Picton East including Woods Road, Gelorup Western Australia; Reserve 23000; Bunbury Outer Ring Road; Margaret River East Conservation Park; Dardanup Nature Reserve; Tuart Forest National Park - Ludlow (CALM Act Land); Kemerton Industrial Park; Yelverton National Park; Locke Nature Reserve (CALM Act Land), Leeuwin-Naturaliste National Park; Areas surrounding Albany including Denmark Catchment National, Mill Brook Nature Reserve, Gull Rock National Park; Manjimup Forested Areas; East Augusta"

AUTHORISED PERSONS

The following persons or persons of the specified class may assist in carrying out the licensed activities:

1. Roy Teale
2. Garth Humphreys
3. Stewart Ford
4. John Graff
5. Penny Brooshooft
6. Victoria Ford
7. David Keirle
8. Michael Greenham
9. Daniel Kamien

10. Brandon King
11. Timothy Sachse
12. Zoe Hamilton
13. Sylvie Schmidt
14. Joshua Keen
15. Dr Peter Kendrick
16. Dr Alexander Kabat

CONDITIONS

1. Fauna must not be taken on CALM land, (as defined in the Conservation and Land Management Regulations 2002), unless authorised by a written notice of a lawful authority issued under regulations 4 and 8 of the Conservation and Land Management Regulations 2002.
2. If persons, other than the licence holder, are authorised to carry out/assist in carrying out the activities under the licence, the licence holder must ensure those persons have read and understand the licence terms and conditions.
3. The written authorisation of the person in possession or occupation of the land accessed and upon which fauna is taken, as required under regulation 101(2) and referred to in "Additional information" below, must:
 - a) state location details (including lot or location number, street/road, suburb and local government authority);
 - b) state land owner or occupier name, and contact phone number;
 - c) specify the time period that the authorisation is valid for;
 - d) be signed and dated; and
 - e) be attached to this licence at all times.
4. This licence, and any written authorisation or lawful authority which authorises the take of fauna on specified locations must be carried at all times while conducting licensed activities and be produced on demand by a wildlife officer.
5. If a species of fauna listed as a threatened species under Section 19 of the *Biodiversity Conservation Act 2016* is inadvertently captured, that species is to be released immediately at the point of capture. If the fauna is injured or deceased, the licence holder shall contact the DBCA Wildlife Licensing Section (wildlifelicensing@dbca.wa.gov.au) for advice on treatment or disposal. Details of any capture of threatened fauna must be included in the "Return of Fauna Taken."
6. The licence holder must not:
 - a) release any fauna in any area where it does not naturally occur;
 - b) transfer fauna to any other person or authority (other than the Western Australian Museum) unless approved in writing by the CEO; or
 - c) dispose of the remains of fauna in any manner likely to interfere the natural or present day distribution of the species.
7. The licence holder must not take and remove more than ten specimens of any one protected species of fauna from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.
8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence must be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range must be offered to the Western Australian Museum.

9. All specimens and material retained under the authority of this licence must be offered to the Western Australian Museum for loan, for inclusion in its collection, or on request be made available to other persons involved in relevant scientific studies.
10. The licence holder must create, compile and maintain records and information as required in a DBCA approved "Return of Fauna Taken" of all fauna taking activities as they occur.
11. A DBCA approved "Return of Fauna Taken" must be completed in full (including nil taking details) and submitted to DBCA Wildlife Licensing Section (wildlifelicensing@dbca.wa.gov.au) prior to the end of each annual period of the licence (from the valid from date) (refer to "Additional Information" section below).
12. Department of Biodiversity, Conservation and Attractions regional/district office(s), and where applicable park ranger(s), are to be contacted by the licensee or Authorised Person at least 48 hours prior to activities taking place in CALM Estate under the authority of this licence.



Danny Stefoni
LICENSING OFFICER
WILDLIFE PROTECTION BRANCH

Delegate of CEO

ADDITIONAL INFORMATION

1. It is an offence to take any species of fauna listed as a threatened species under Section 19 of the *Biodiversity Conservation Act 2016* unless the person is authorised under Section 40. The penalty ranges between \$300 000 and \$500 000; Section 150 Biodiversity Conservation Act 2016.
2. The licence holder, if affected by a condition imposed in this licence, may apply to the State Administrative Tribunal for review of the decision of the CEO to impose that condition on a licence: regulation 89(2) Biodiversity Conservation Regulations 2018.
3. A person must not contravene a condition of a licence. The penalty for an offence involving the contravention of a condition of a licence is a fine of \$10 000: regulation 84 of the Biodiversity Conservation Regulations 2018.
4. It is an offence for persons authorised by this licence to enter land that is not in their possession or under their control without first having the *prior* written authorisation of the current owner or occupier of the land to:
 - a) enter the land; and
 - b) carry out the activity authorised by this licence.The penalty for this offence is a fine of \$5 000: regulation 101(2) of the Biodiversity Conservation Regulations 2018.
5. The licence holder must be able to produce for inspection upon request any information or records required by regulation 85(2) of the Biodiversity Conservation Regulations 2018 Penalty \$10 000. It is an offence to knowingly include false or misleading information or make statements in records: regulation 85(3) of the Biodiversity Conservation Regulations 2018 Penalty \$10 000. It is an offence to



include any information or make any statement in a return that the licence holder knows to be false or misleading in a material particular: regulation 86 (2) of the Biodiversity Conservation Regulations 2018 Penalty \$10 000.

6. The approved DBCA “Return of Fauna Taken” data file can be downloaded from the DBCA webpage (<https://www.dpaw.wa.gov.au/plants-and-animals/licences-and-authorities>).
7. The issuing of a licence under the Biodiversity Conservation Regulations 2018 does not constitute an animal ethics approval or a licence to use animals for scientific purposes as required under the *Animal Welfare Act 2002*, Animal Welfare (Scientific Purposes) Regulations 2003. It is the responsibility of a licence applicant / licence holder to ensure that they comply with the requirements of all applicable legislation. Enquiries relating to the Animal Welfare Act licences and animal ethics approvals are to be directed to the Department of Primary Industries and Regional Development (<https://www.agric.wa.gov.au/animalwelfare>).
8. Threatened fauna can only be taken under a *Biodiversity Conservation Act 2016* Section 40 authorisation, Occurrences of threatened species must be reported to the CEO. For more information please see <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals>.
9. Any interaction involving Nationally Listed Threatened Fauna that may be invasive and/or harmful to the fauna may require approval from the Commonwealth Department of the Environment and Energy <http://www.environment.gov.au/about-us/business-us/permits-assessments-licences>. Interaction with such species is controlled by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the *Biodiversity Conservation Act 2016* and Biodiversity Conservation Regulations 2018.

Appendix 3

Desktop Review Results



A3: Mammals

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	Lot 1 Ducane 2014	GHD 2012	Waterloo 2015
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	CR	EN	•					
<i>Bos taurus</i>	European Cattle			•	•	•	•		
<i>Canis lupus familiaris</i>	Domestic Dog				•		•	•	
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda			•					
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	VU	VU	•	•				
<i>Equus caballus</i>	Horse					•	•		
<i>Falsistrellus mackenziei</i>	Western Falsistrelle	P4		•					
<i>Felis catus</i>	Cat			•	•	•		•	•
<i>Feral Deer</i>	Feral Deer				•				
<i>Hydromys chrysogaster</i>	Water-rat, Rakali	P4		•					•
<i>Isoodon fusciventer</i>	Southern Brown Bandicoot	P4		•			•	•	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			•			•	•	•
<i>Mus musculus</i>	House Mouse			•					
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		•					
<i>Oryctolagus cuniculus</i>	Rabbit			•		•	•	•	•
<i>Phascogale tapoatafa wambenger</i>	Wambenger Brush-tailed Phascogale	CD		•					
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	•	•	•	•	•	•
<i>Rattus fuscipes</i>	Western Bush Rat			•					
<i>Rattus rattus</i>	Black Rat			•				•	
<i>Setonix brachyurus</i>	Quokka	VU	VU	•	•				
<i>Sus scrofa</i>	Pig			•					
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna							•	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum			•			•	•	•
<i>Vulpes vulpes</i>	Fox					•	•	•	•

A3: Birds

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Acanthiza apicalis</i>	Inland Thornbill			•					
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			•			•	•	•
<i>Acanthiza inornata</i>	Western Thornbill			•			•	•	
<i>Acanthorhynchus superciliosus</i>	Western Spinebill			•					•
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk			•					
<i>Accipiter fasciatus</i>	Brown Goshawk		MA	•					•
<i>Acrocephalus australis</i>	Australian Reed-Warbler			•					
<i>Actitis hypoleucos</i>	Common Sandpiper	IA	M; MA	•	•				
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar			•					
<i>Anas castanea</i>	Chestnut Teal			•					
<i>Anas gracilis</i>	Grey Teal			•					•
<i>Anas superciliosa</i>	Pacific Black Duck			•			•		•
<i>Anhinga novaehollandiae</i>	Australasian Darter			•					
<i>Anthochaera carunculata</i>	Red Wattlebird			•			•	•	•
<i>Anthochaera lunulata</i>	Western Wattlebird			•			•		
<i>Anthus novaeseelandiae</i>	Australasian Pipit		MA			•	•		•
<i>Apus pacificus</i>	Fork-tailed Swift	IA	M; MA		•				
<i>Aquila audax</i>	Wedge-tailed Eagle			•			•		
<i>Ardea alba</i>	Great Egret			•	•				
<i>Ardea pacifica</i>	White-necked Heron			•					
<i>Arenaria interpres</i>	Ruddy Turnstone	IA	M; MA	•					
<i>Artamus cinereus</i>	Black-faced Woodswallow			•			•		•
<i>Artamus cyanopterus</i>	Dusky Woodswallow			•		•			•
<i>Aythya australis</i>	Hardhead			•					
<i>Barnardius zonarius</i>	Australian Ringneck			•		•	•	•	•
<i>Biziura lobata</i>	Musk Duck		MA	•					•

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	•	•				
<i>Bubulcus ibis</i>	Cattle Egret			•	•				
<i>Burhinus grallarius</i>	Bush Stone-curlew			•					
<i>Butorides striata</i>	Striated Heron								•
<i>Cacatua pastinator</i>	Western Corella			•					
<i>Cacatua sanguinea</i>	Little Corella			•					•
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo		MA	•			•		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	IA	M; MA	•	•				
<i>Calidris alba</i>	Sanderling	IA	M; MA	•					
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR; IA	CR; M; MA	•	•				
<i>Calidris melanotos</i>	Pectoral Sandpiper	IA	M; MA		•				
<i>Calidris ruficollis</i>	Red-necked Stint	IA	M; MA	•					
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	VU	VU	•	•		•	•	•
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	EN	EN	•	•				
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	EN	EN	•	•		•	•	
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo			•					
<i>Chenonetta jubata</i>	Australian Wood Duck			•			•		•
<i>Chroicocephalus novaehollandiae</i>	Silver Gull		MA	•					
<i>Cincloramphus mathewsi</i>	Rufous Songlark								•
<i>Circus approximans</i>	Swamp Harrier		MA	•					
<i>Cladorhynchus leucocephalus</i>	Banded Stilt			•					
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			•			•	•	•
<i>Columba livia</i>	Rock Dove			•	•				•
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		MA	•		•	•	•	•
<i>Corvus bennetti</i>	Little Crow								•
<i>Corvus coronoides</i>	Australian Raven			•		•	•	•	•
<i>Coturnix pectoralis</i>	Stubble Quail		MA	•					

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Cracticus nigrogularis</i>	Pied Butcherbird			•					•
<i>Cracticus torquatus</i>	Grey Butcherbird			•			•		•
<i>Cygnus atratus</i>	Black Swan			•					
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			•			•	•	•
<i>Daphoenositta chrysoptera</i>	Varied Sittella			•			•		
<i>Dromaius novaehollandiae</i>	Emu			•					
<i>Egretta garzetta</i>	Little Egret		MA						•
<i>Egretta novaehollandiae</i>	White-faced Heron			•			•		•
<i>Elanus axillaris</i>	Black-shouldered Kite								•
<i>Eseyornis melanops</i>	Black-fronted Dotterel			•					•
<i>Eolophus roseicapilla</i>	Galah			•			•	•	•
<i>Eopsaltria australis</i>	Eastern Yellow Robin			•			•		
<i>Epthianura albifrons</i>	White-fronted Chat			•					•
<i>Eurostopodus argus</i>	Spotted Nightjar		MA	•					
<i>Falco berigora</i>	Brown Falcon			•					•
<i>Falco cenchroides</i>	Nankeen Kestrel		MA	•		•	•		•
<i>Falco longipennis</i>	Australian Hobby			•			•		
<i>Falco peregrinus</i>	Peregrine Falcon	OS		•					•
<i>Falcunculus frontatus</i>	Crested Shrike-tit			•					
<i>Fulica atra</i>	Eurasian Coot			•			•		•
<i>Gallinula tenebrosa</i>	Dusky Moorhen			•					•
<i>Gavicalis virescens</i>	Singing Honeyeater					•	•		•
<i>Gerygone fusca</i>	Western Gerygone			•			•	•	•
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet						•		
<i>Grallina cyanoleuca</i>	Magpie-lark		MA	•			•		•
<i>Gymnorhina tibicen</i>	Australian Magpie			•		•	•	•	•
<i>Haliastur sphenurus</i>	Whistling Kite		MA	•			•	•	

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Heteroscenes pallidus</i>	Pallid Cuckoo			•					•
<i>Hieraaetus morphnoides</i>	Little Eagle			•					
<i>Himantopus leucocephalus</i>	Pied Stilt			•					
<i>Hirundo neoxena</i>	Welcome Swallow		MA	•			•	•	•
<i>Hypotaenidia philippensis</i>	Buff-banded Rail			•					
<i>Lichmera indistincta</i>	Brown Honeyeater			•		•	•	•	•
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck			•					
<i>Malurus elegans</i>	Red-winged Fairy-wren			•				•	
<i>Malurus splendens</i>	Splendid Fairy-wren			•			•		•
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			•					
<i>Merops ornatus</i>	Rainbow Bee-eater		MA	•	•	•			
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant			•			•		•
<i>Microeca fascinans</i>	Jacky Winter						•		
<i>Motacilla cinerea</i>	Grey Wagtail	IA	M; MA		•				
<i>Neophema elegans</i>	Elegant Parrot			•			•		•
<i>Neophema petrophila</i>	Rock Parrot		MA	•					
<i>Ninox boobook</i>	Southern Boobook					•		•	•
<i>Numenius madagascariensis</i>	Eastern Curlew	CR; IA	CR; M; MA	•	•				
<i>Numenius phaeopus</i>	Whimbrel	IA	M; MA	•					
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron		MA	•					
<i>Ocyphaps lophotes</i>	Crested Pigeon			•					•
<i>Oxyura australis</i>	Blue-billed Duck	P4		•					
<i>Pachycephala pectoralis</i>	Golden Whistler						•	•	
<i>Pachycephala rufiventris</i>	Rufous Whistler			•		•	•	•	•
<i>Pandion haliaetus</i>	Eastern Osprey			•	•				
<i>Pardalotus punctatus</i>	Spotted Pardalote			•					•
<i>Pardalotus striatus</i>	Striated Pardalote			•		•	•		•

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Pelecanus conspicillatus</i>	Australian Pelican		MA	•					
<i>Petrochelidon nigricans</i>	Tree Martin		MA	•			•		
<i>Petroica multicolor</i>	Scarlet Robin			•		•	•	•	
<i>Phalacrocorax carbo</i>	Great Cormorant			•					
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant		MA	•					
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant			•					•
<i>Phalacrocorax varius</i>	Pied Cormorant			•					
<i>Phaps chalcoptera</i>	Common Bronzewing			•			•	•	•
<i>Phaps elegans</i>	Brush Bronzewing			•					
<i>Phylidonyris niger</i>	White-cheeked Honeyeater			•					
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater			•			•	•	•
<i>Platalea flavipes</i>	Yellow-billed Spoonbill			•			•		•
<i>Platalea regia</i>	Royal Spoonbill			•					
<i>Plegadis falcinellus</i>	Glossy Ibis	IA	M; MA	•					
<i>Pluvialis fulva</i>	Pacific Golden Plover	IA	M; MA	•					
<i>Podargus strigoides</i>	Tawny Frogmouth			•			•	•	
<i>Podiceps cristatus</i>	Great Crested Grebe			•					
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe			•					
<i>Polytelis anthopeplus</i>	Regent Parrot			•			•		•
<i>Poodytes gramineus</i>	Little Grassbird			•				•	
<i>Porphyrio porphyrio</i>	Purple Swamphen		MA	•					•
<i>Purpureicephalus spurius</i>	Red-capped Parrot			•		•	•	•	•
<i>Quoyornis georgianus</i>	White-breasted Robin			•					
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet		MA	•					
<i>Rhipidura fuliginosa</i>	Grey Fantail			•		•	•		•
<i>Rhipidura leucophrys</i>	Willie Wagtail			•		•	•	•	•
<i>Rhipidura rufiventris</i>	Northern Fantail			•					

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Rostratula australis</i>	Australian Painted-snipe	S2	EN		•				
<i>Sericornis frontalis</i>	White-browed Scrubwren			•			•		
<i>Smicronis brevirostris</i>	Weebill			•		•	•	•	•
<i>Spatula rhynchotis</i>	Australasian Shoveler			•					
<i>Stictonetta naevosa</i>	Freckled Duck			•					
<i>Stipiturus malachurus</i>	Southern Emu-wren			•					
<i>Strepera versicolor</i>	Grey Currawong			•			•		•
<i>Streptopelia chinensis</i>	Spotted Dove			•					
<i>Streptopelia senegalensis</i>	Laughing Dove			•	•			•	
<i>Sturnus vulgaris</i>	Common Starling				•				
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe			•					
<i>Tadorna tadornoides</i>	Australian Shelduck			•			•		•
<i>Threskiornis moluccus</i>	Australian White Ibis						•	•	•
<i>Threskiornis spinicollis</i>	Straw-necked Ibis		MA	•			•		•
<i>Todiramphus sanctus</i>	Sacred Kingfisher		MA	•				•	•
<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet			•				•	
<i>Tringa brevipes</i>	Grey-tailed Tattler	IA; P4	M	•					
<i>Tringa glareola</i>	Wood Sandpiper	IA	M; MA	•					
<i>Tringa nebularia</i>	Common Greenshank	IA	M; MA	•	•				
<i>Tringa stagnatilis</i>	Marsh Sandpiper	IA	M; MA	•					
<i>Turnix varius varius</i>	Australian Painted Button-quail								
<i>Vanellus tricolor</i>	Banded Lapwing			•					
<i>Xenus cinereus</i>	Terek Sandpiper	IA	M; MA	•					
<i>Zapornia tabuensis</i>	Spotless Crane			•					
<i>Zosterops lateralis</i>	Silvereye		MA	•			•	•	•

A3: Reptiles

Species Name	Common Name	State Listing	C' weath Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1Ducane 2014	Waterloo 2015
<i>Acritoscincus trilineatus</i>	Western Three-lined Skink			•			•		
<i>Aprasia repens</i>	Sand-plain Worm-lizard			•					
<i>Christinus marmoratus</i>	Marbled Gecko			•		•			
<i>Cryptoblepharus buchananii</i>				•			•		
<i>Ctenotus australis</i>				•					
<i>Ctenotus fallens</i>				•					
<i>Ctenotus impar</i>				•					
<i>Ctenotus labillardieri</i>				•					
<i>Ctenotus ora</i>	Coastal Plains Skink	P3		•					
<i>Egernia kingii</i>	King's Skink			•		•			•
<i>Egernia napoleonis</i>				•			•		•
<i>Elapognathus coronatus</i>	Crowned Snake			•					
<i>Hemiernis gracilipes</i>				•					
<i>Hemiernis quadrilineata</i>				•			•		
<i>Lerista distinguenda</i>				•					
<i>Lerista elegans</i>				•					
<i>Lialis burtonis</i>				•					
<i>Lissolepis luctuosa</i>	Western Swamp Skink			•					
<i>Menetia greyii</i>				•		•	•		•
<i>Morethia lineocellata</i>				•					•
<i>Morethia obscura</i>						•	•		
<i>Neelaps bimaculatus</i>	Black-naped Snake			•					
<i>Notechis scutatus</i>	Tiger Snake			•					
<i>Parasuta gouldii</i>				•					
<i>Parasuta nigriceps</i>				•					
<i>Pogona minor</i>	Dwarf Bearded Dragon			•		•			
<i>Pseudonaja affinis</i>	Dugite			•			•		•
<i>Simoselaps bertholdi</i>	Jan's Banded Snake			•					

Species Name	Common Name	State Listing	C' wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Tiliqua rugosa</i>				•		•	•		

A3: Amphibians

Species Name	Common Name	State Listing	EPBC Act	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Crinia georgiana</i>	Quacking Frog			•					•
<i>Crinia glauerti</i>	Clicking Frog			•			•	•	•
<i>Crinia insignifera</i>	Squelching Froglet			•			•	•	•
<i>Crinia pseudinsignifera</i>	Bleating Froglet			•					
<i>Geocrinia leai</i>	Ticking Frog			•				•	
<i>Heleioporus eyrei</i>	Moaning Frog			•					•
<i>Limnodynastes dorsalis</i>	Western Banjo Frog			•					•
<i>Litoria adelaidensis</i>	Slender Tree Frog			•			•		•
<i>Litoria moorei</i>	Motorbike Frog			•					•
<i>Pseudophryne guentheri</i>	Crawling Toadlet			•					

Appendix 4

NatureMap Database Search Results



NatureMap Species Report

Created By Guest user on 04/09/2019

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Species Group Amphibians
Method 'By Line'
Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27'
Group By 24" S, 115° 36' 11" E
 Species Group

Species Group	Species	Records
Amphibian	10	300
TOTAL	10	300

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Amphibian				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
5.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
6.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
7.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
8.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
9.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
10.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			

Conservation Codes
 T - Rare or likely to become extinct
 X - Presumed extinct
 IA - Protected under international agreement
 S - Other specially protected fauna
 1 - Priority 1
 2 - Priority 2
 3 - Priority 3
 4 - Priority 4
 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap Species Report

Created By Guest user on 07/03/2019

Current Names Only Yes

Core Datasets Only Yes

Species Group Birds

Method 'By Line'

Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27' 24" S, 115° 36' 11" E

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
5.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
6.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
7.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
8.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
9.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
10.	24310 <i>Anas castanea</i> (Chestnut Teal)			
11.	24312 <i>Anas gracilis</i> (Grey Teal)			
12.	24313 <i>Anas platyrhynchos</i> (Mallard)			
13.	<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
14.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
15.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
16.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
17.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
18.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
19.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
20.	25558 <i>Ardea ibis</i> (Cattle Egret)			
21.	41324 <i>Ardea modesta</i> (great egret, white egret)			
22.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
23.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
24.	41326 <i>Ardenna carneipes</i> (Flesh-footed Shearwater, Fleshy-footed Shearwater)		T	
25.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
26.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
27.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
28.	24318 <i>Aythya australis</i> (Hardhead)			
29.	<i>Barnardius zonarius</i>			
30.	24319 <i>Biziura lobata</i> (Musk Duck)			
31.	24345 <i>Botaurus poiciloptilus</i> (Australasian Bittern)		T	
32.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
33.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
34.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
35.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
36.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
37.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
38.	24780 <i>Calidris alba</i> (Sanderling)		IA	
39.	25738 <i>Calidris canutus</i> (Red Knot, knot)		IA	
40.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
41.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
42.	24790 <i>Calidris tenuirostris</i> (Great Knot)		T	
43.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
44.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
45.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
46.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
47.	48400 <i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
48.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
49.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
50.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
51.	<i>Chroicocephalus novaehollandiae</i>			
52.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
53.	24288 <i>Circus approximans</i> (Swamp Harrier)			
54.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
55.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
56.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
57.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
58.	25592 <i>Corvus coronoides</i> (Australian Raven)			
59.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
60.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
61.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
62.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
63.	<i>Cracticus torquatus</i>			
64.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
65.	24322 <i>Cygnus atratus</i> (Black Swan)			
66.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
67.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
68.	25618 <i>Diomedea exulans</i> (Wandering Albatross)		T	
69.	30836 <i>Diomedea exulans</i> subsp. <i>exulans</i> (Snowy Albatross)		T	
70.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
71.	<i>Egretta garzetta</i>			
72.	<i>Egretta novaehollandiae</i>			
73.	<i>Elanus axillaris</i>			
74.	47937 <i>Elseornis melanops</i> (Black-fronted Dotterel)			
75.	<i>Eolophus roseicapillus</i>			
76.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
77.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
78.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
79.	24813 <i>Eudyptes chrysocome</i> subsp. <i>filholi</i> (Rockhopper Penguin)			Y
80.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
81.	25621 <i>Falco berigora</i> (Brown Falcon)			
82.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
83.	25623 <i>Falco longipennis</i> (Australian Hobby)			
84.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
85.	24616 <i>Falculunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)			
86.	25727 <i>Fulica atra</i> (Eurasian Coot)			
87.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
88.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
89.	24763 <i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
90.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
91.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
92.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
93.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
94.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
95.	24295 <i>Haliaeetus spheonurus</i> (Whistling Kite)			
96.	24689 <i>Halobaena caerulea</i> (Blue Petrel)			
97.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
98.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
99.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
100.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
101.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
102.	25638 <i>Larus pacificus</i> (Pacific Gull)			
103.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
104.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
105.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
106.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
107.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
108.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
109.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
110.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
111.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
112.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
113.	<i>Microcarbo melanoleucos</i>			
114.	48008 <i>Morus serrator</i> (Australasian Gannet)			
115.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
116.	24739 <i>Neophema petrophila</i> (Rock Parrot)			
117.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
118.	25742 <i>Numenius phaeopus</i> (Whimbrel)		IA	
119.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
120.	24497 <i>Oceanites oceanicus</i> (Wilson's Storm-petrel)		IA	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
121.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
122.	41347 <i>Onychoprion anaethetus</i> (Bridled Tern)		IA	
123.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
124.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
125.	24692 <i>Pachyptila belcheri</i> (Slender-billed Prion)			
126.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
127.	25707 <i>Pachyptila salvini</i> (Salvin's Prion)			
128.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
129.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
130.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
131.	25687 <i>Passer domesticus</i> (House Sparrow)	Y		
132.	24642 <i>Passer montanus</i> (Eurasian Tree Sparrow)	Y		
133.	24649 <i>Pelecanoides urinatrix</i> subsp. <i>exsul</i> (Common Diving Petrel)			
134.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
135.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
136.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
137.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
138.	24664 <i>Phalacrocorax carbo</i> subsp. <i>novaehollandiae</i> (Great Cormorant)			
139.	24665 <i>Phalacrocorax fuscescens</i> (Black-faced Cormorant)			
140.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
141.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
142.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
143.	24668 <i>Phalacrocorax varius</i> subsp. <i>hypoleucos</i> (Pied Cormorant)			
144.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
145.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
146.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
147.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
148.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
149.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
150.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
151.	24745 <i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
152.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
153.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
154.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
155.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
156.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
157.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
158.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
159.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
160.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
161.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
162.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
163.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
164.	24388 <i>Psophodes nigrogularis</i> subsp. <i>nigrogularis</i> (Western Whipbird (western heath))		T	
165.	24702 <i>Pterodroma brevirostris</i> (Kerguelen Petrel)			
166.	24703 <i>Pterodroma lessonii</i> (White-headed Petrel)			
167.	<i>Pterodroma macroptera</i> subsp. <i>macroptera</i>			
168.	25711 <i>Pterodroma mollis</i> (Soft-plumaged Petrel)			
169.	24711 <i>Puffinus assimilis</i> subsp. <i>assimilis</i> (Little Shearwater)			
170.	<i>Purpureicephalus spurius</i>			
171.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
172.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
173.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
174.	25616 <i>Rhipidura rufiventris</i> (Northern Fantail)			
175.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
176.	30948 <i>Sericornis brevirostris</i> (Weebill)			
177.	24522 <i>Sterna bergii</i> (Crested Tern)			
178.	25642 <i>Sterna hirundo</i> (Common Tern)		IA	
179.	48594 <i>Sternula nereis</i> (Fairy Tern)			
180.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
181.	25655 <i>Stipiturus malachurus</i> (Southern Emu-wren)			
182.	24554 <i>Stipiturus malachurus</i> subsp. <i>westernensis</i> (Southern Emu-wren)			
183.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
184.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
185.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
186.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
187.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
188.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
189.	34134 <i>Thalassarche carteri</i> (Indian Yellow-nosed Albatross)		T	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
190.	44607 <i>Thalassarche melanophris</i> (Black-browed Albatross)		T	
191.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
192.	48135 <i>Thinornis rubricollis</i> (Hooded Plover, Hooded Dotterel)		P4	
193.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
194.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
195.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
196.	24755 <i>Trichoglossus haematodus</i> subsp. <i>moluccanus</i> (Rainbow Lorikeet)	Y		
197.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
198.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
199.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
200.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
201.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
202.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
203.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

Conservation Codes

T - Rare or likely to become extinct
 X - Presumed extinct
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 S - Other specially protected fauna
 1 - Priority 1
 2 - Priority 2
 3 - Priority 3
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NatureMap Species Report

Created By Guest user on 07/03/2019

Current Names Only Yes

Core Datasets Only Yes

Species Group Mammals

Method 'By Line'

Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27' 24" S, 115° 36' 11" E

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	24208 <i>Arctocephalus forsteri</i> (New Zealand Fur Seal, long-nosed fur-seal)		S	
2.	24209 <i>Arctocephalus tropicalis</i> (Subantarctic fur-seal)		T	
3.	24044 <i>Balaenoptera acutorostrata</i> (Dwarf Minke Whale)			
4.	24162 <i>Bettongia penicillata</i> subsp. <i>ogilbyi</i> (Woylie, Brush-tailed Bettong)		T	
5.	24251 <i>Bos taurus</i> (European Cattle)	Y		
6.	24072 <i>Caperea marginata</i> (Pygmy Right Whale)			
7.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
8.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
9.	24043 <i>Eubalaena australis</i> (Southern Right Whale)		T	
10.	24189 <i>Falsistrellus mackenziei</i> (Western False Pipistrelle, Western Falsistrelle)		P4	
11.	24041 <i>Felis catus</i> (Cat)	Y		
12.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
13.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
14.	<i>Lobodon carcinophaga</i>			
15.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
16.	24051 <i>Megaptera novaeangliae</i> (Humpback Whale)		S	
17.	24076 <i>Mesoplodon bowdoini</i> (Andrew's Beaked Whale)			
18.	24078 <i>Mesoplodon grayi</i> (Gray's Beaked Whale)			
19.	24081 <i>Mesoplodon mirus</i> (True's Beaked Whale)			
20.	24213 <i>Mirounga leonina</i> (Southern Elephant Seal)			
21.	24223 <i>Mus musculus</i> (House Mouse)	Y		
22.	24210 <i>Neophoca cinerea</i> (Australian Sea-lion)		T	
23.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
24.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
25.	25508 <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)		S	
26.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
27.	24073 <i>Physeter macrocephalus</i> (Sperm Whale)		T	
28.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
29.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
30.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
31.	24145 <i>Setonix brachyurus</i> (Quokka)		T	
32.	48113 <i>Stenella coeruleoalba</i> (Striped Dolphin)			
33.	48114 <i>Stenella longirostris</i> (Spinner Dolphin)		P4	
34.	24259 <i>Sus scrofa</i> (Pig)	Y		
35.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
36.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
37.	30954 <i>Tursiops aduncus</i> (Indo-Pacific Bottlenose Dolphin)			
38.	24069 <i>Tursiops truncatus</i> (Bottlenose Dolphin)			

Conservation Codes

T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap Species Report

Created By Guest user on 04/09/2019

Current Names Only Yes
 Core Datasets Only Yes
 Species Group Reptiles
 Method 'By Line'
 Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27'
 Group By 24" S, 115° 36' 11" E
 Species Group

Species Group	Species	Records
Reptile	36	202
TOTAL	36	202

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Reptile				
1.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
2.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
3.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		T	
4.	25336 <i>Chelonia mydas</i> (Green Turtle)		T	
5.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
6.	30893 <i>Cryptoblepharus buchananii</i>			
7.	25027 <i>Ctenotus australis</i>			
8.	25039 <i>Ctenotus fallens</i>			
9.	25047 <i>Ctenotus impar</i>			
10.	25049 <i>Ctenotus labillardieri</i>			
11.	41641 <i>Ctenotus ora</i> (Coastal Plains Skink)		P3	
12.	25096 <i>Egernia kingii</i> (King's Skink)			
13.	25100 <i>Egernia napoleonis</i>			
14.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
15.	30919 <i>Hemiergis gracilipes</i> (skink)			
16.	25119 <i>Hemiergis quadrilineata</i>			
17.	44656 <i>Hydrophis major</i> (Olive-headed seasnake, greater seasnake)			
18.	42410 <i>Hydrophis ornatus</i> (Ornate Reef Seasnake, Sea Snake)			
19.	43384 <i>Hydrophis platurus</i> (Yellow-bellied Seasnake)			
20.	25131 <i>Lerista distinguenda</i>			
21.	25133 <i>Lerista elegans</i>			
22.	25005 <i>Lialis burtonis</i>			
23.	42413 <i>Lissolepis luctuosa</i> (Western Swamp Skink)			
24.	25184 <i>Menetia greyii</i>			
25.	25191 <i>Morethia lineocellata</i>			
26.	25344 <i>Natator depressus</i> (Flatback Turtle)		T	
27.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
28.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
29.	25253 <i>Parasuta gouldii</i>			
30.	25255 <i>Parasuta nigriceps</i>			
31.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
32.	24907 <i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
33.	25259 <i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
34.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
35.	25519 <i>Tiliqua rugosa</i>			
36.	25207 <i>Tiliqua rugosa subsp. rugosa</i>			

Conservation Codes
 T - Rare or likely to become extinct
 X - Presumed extinct
 IA - Protected under international agreement
 S - Other specially protected fauna
 1 - Priority 1
 2 - Priority 2
 3 - Priority 3
 4 - Priority 4
 5 - Priority 5

Name ID Species Name

Naturalised

Conservation Code

¹Endemic To Query Area

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 5

EPBC Act Protected Matters Search Tool Results





EPBC Act Protected Matters Report

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

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

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

Report created: 29/10/18 15:42:29

[Summary](#)

[Details](#)

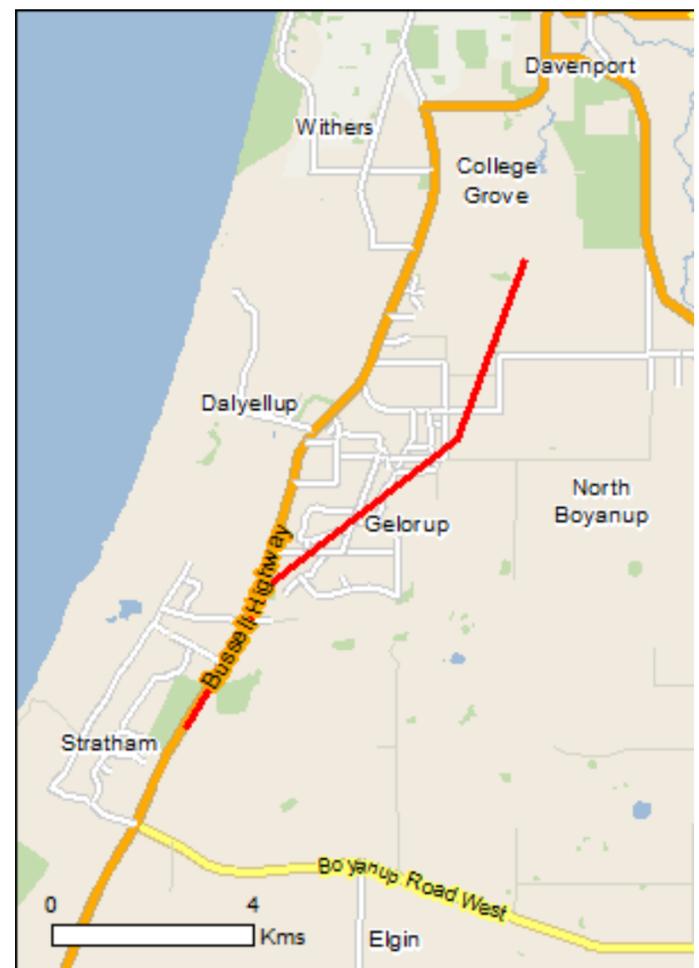
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

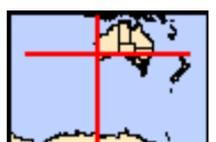
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	66
Listed Migratory Species:	43

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	69
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	2

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)

[\[Resource Information \]](#)

Name	Proximity
Vasse-wonnerup system	Within 10km of Ramsar

Commonwealth Marine Area

[\[Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions

[\[Resource Information \]](#)

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-west

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	related behaviour may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat known to occur within area
Austrostipa jacobiana [87809]	Critically Endangered	Species or species habitat known to occur within area
Banksia nivea subsp. uliginosa Swamp Honey-pot [82766]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area

Reptiles

Name	Status	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Sharks

Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[[Resource Information](#)]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific		Species or species

Name	Threatened	Type of Presence
Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995] Megaptera novaeangliae		habitat may occur within area
Humpback Whale [38] Natator depressus	Vulnerable	Congregation or aggregation known to occur within area
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[[Resource Information](#)]

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

Name

Commonwealth Land -
Defence - BUNBURY TRAINING DEPOT

Listed Marine Species

[[Resource Information](#)]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Name	Threatened	Type of Presence
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Australian Marine Parks		[Resource Information]
Name	Label	
Geographe	Special Purpose Zone (Mining	

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Leschenault Peninsula	WA
NTWA Bushland covenant (0022)	WA
Tuart Forest	WA
Unnamed WA03249	WA
Unnamed WA40552	WA

Invasive Species [\[Resource Information \]](#)

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

Name	Status	Type of Presence
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Birds

Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
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Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
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Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
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Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
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Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
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Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
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Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
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Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
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Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
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Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
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Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
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Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur
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Name	Status	Type of Presence
<p>Rattus rattus Black Rat, Ship Rat [84]</p>		<p>within area</p> <p>Species or species habitat likely to occur within area</p>
<p>Sus scrofa Pig [6]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Vulpes vulpes Red Fox, Fox [18]</p>		<p>Species or species habitat likely to occur within area</p>
Plants		
<p>Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Asparagus plumosus Climbing Asparagus-fern [48993]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Brachiaria mutica Para Grass [5879]</p>		<p>Species or species habitat may occur within area</p>
<p>Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]</p>		<p>Species or species habitat may occur within area</p>
<p>Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]</p>		<p>Species or species habitat may occur within area</p>
<p>Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Genista sp. X Genista monspessulana Broom [67538]</p>		<p>Species or species habitat may occur within area</p>
<p>Lycium ferocissimum African Boxthorn, Boxthorn [19235]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Olea europaea Olive, Common Olive [9160]</p>		<p>Species or species habitat may occur within area</p>
<p>Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]</p>		<p>Species or species habitat may occur within area</p>
<p>Rubus fruticosus aggregate Blackberry, European Blackberry [68406]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade,</p>		<p>Species or species habitat likely to occur</p>

Name	Status	Type of Presence
Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		within area

Key Ecological Features (Marine) [\[Resource Information \]](#)

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Commonwealth marine environment within and	South-west
Western rock lobster	South-west

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.38722 115.66361,-33.41389 115.65167,-33.435 115.61833,-33.45667 115.60306

Acknowledgements

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

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

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

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