



# Flora and fauna survey for the proposed Butler North District Open Space Project

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**City of Wanneroo**

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## DOCUMENT TRACKING

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# Executive summary

The City of Wanneroo (the City) is proposing to develop two sites located within the suburb of Alkimos in the City of Wanneroo (the project), situated approximately 39 kilometres north of Perth. Eco Logical Australia (ELA) was commissioned by the City to undertake a Level 2 flora and Level 1 fauna survey within the study area in order to provide the City with a greater understanding of the potential impacts on remnant native vegetation from the project, and to facilitate and enable any necessary environmental and planning approvals from State and Commonwealth Governments.

The Level 2 flora and Level 1 fauna survey was carried out on 3<sup>rd</sup> November 2016 by one botanist and one zoologist. A flora species inventory and vegetation community and condition mapping were described through the establishment of six 10 m x 10 m quadrats and two relevés. Conservation listed flora were recorded and mapped through systematic traverses. Floristic Community Type analysis was also undertaken.

Opportunistic observations of fauna and fauna habitat mapping were taken whilst traversing the study area. In addition, an assessment of Black Cockatoo habitat was undertaken in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* referral guidelines (Department of Sustainability, Environment, Water, Populations and Communities).

A total of 98 flora taxa were identified within the study area. This total included 73 native and 25 introduced taxa. No listed Threatened (Declared Rare Flora), Priority or other flora species of conservation significance were recorded in the study area.

Two vegetation communities were described within the study area: *Banksia attenuata* and *Banksia menziesii* low woodland (BaBmLW) and mixed *B. sessilis* open shrubland (BsXpHtTOS). The Floristic Community Type analysis confirmed that two Floristic Community Types occur within the study area: FCT 28 – ‘Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands’ and FCT 24 – ‘Northern Spearwood shrublands and woodlands’.

FCT 28 has recently been listed as a Threatened Ecological Community (Endangered) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. FCT 24 is currently listed as a Priority 3 PEC by Department of Parks and Wildlife.

One vegetation community within the study area represents the Threatened Ecological Community Banksia Woodland of the Swan Coastal Plain as it meets the key diagnostic characteristics set out under the approved listing conservation advice: BaBmLW: *Banksia attenuata* and *Banksia menziesii* low woodland.

The condition of the vegetation across the study area was mostly Excellent to Very Good, with some smaller areas in Good or Degraded condition.

A total of 17 vertebrate fauna species were recorded within the study area during the Level 1 fauna survey. This comprised one reptile, 13 birds and three mammals (one native and two introduced). No Threatened fauna were directly observed during the survey. However, Black Cockatoo foraging evidence in the form of chewed *Banksia* cones were observed throughout the study area. In addition, *Merops ornatus* (Rainbow Bee-eater), which is listed in Schedule 5 under the *Wildlife Conservation Act 1950*, was observed nesting adjacent to the study area, and foraging within the study area.

It was concluded that due to the high level of species diversity within the vegetation communities, the occurrence of an Endangered Threatened Ecological Community and Priority 3 Priority Ecological Community, and the occurrence of Threatened fauna, that the study area comprises an important area of remnant vegetation.

Due to the occurrence of Matters of National Environmental Significance (Banksia Woodlands Threatened Ecological Community and Black Cockatoos) within the study area, it is recommended that the City refer the project to the Commonwealth Department of the Environment and Energy and provide a Native Vegetation Clearing Permit to the Department of Environmental Regulation. The project should be assessed under the Bilateral Agreement, omitting the need to provide a separate State referral.

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## Abbreviations

Abbreviation	Description
BoM	Bureau of Meteorology
cm	centimetres
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation (now known as Department of Parks and Wildlife)
DER	Department of Environment Regulation
DPaW	Department of Parks and Wildlife
DotEE	Department of the Environment and Energy (formerly known as Department of Sustainability, Environment, Water, Populations and Communities [SEWPaC])
DRF	Declared Rare Flora
ESA	Environmentally Sensitive Area
ELA	Eco Logical Australia
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
FCT	Floristic Community Type
GPS	Global Positioning System
ha	Hectare
IBRA	Interim Biogeographical Regionalisation for Australia
IUCN	International Union for Conservation of Nature
km	Kilometre
M	Migratory
mm	Millimetre
P	Priority flora or Priority fauna listed by Parks and Wildlife
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
Q	Quadrat
S	Specially protected fauna
SEWPaC	Department of Sustainability, Environment, Water, Populations and Communities (now known as Department of the Environment and Energy [DotEE])



Abbreviation	Description
T	Threatened
TEC	Threatened Ecological Community
the City	City of Wanneroo
VU	Vulnerable
WA	Western Australia
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAPC	Western Australian Planning Commission
WC Act	<i>Wildlife Conservation Act 1950</i> (WA)
WoNS	Weed of National Significance

# 1 Introduction

## 1.1 Project background

The City of Wanneroo (the City) is proposing to develop two sites located within the suburb of Alkimos in the City of Wanneroo, situated approximately 39 kilometres (km) north of Perth (**Figure 1-1**). The sites comprise of two lots: 50K Darbyshire Parade and 25 Halesworth Parade (the study area), which are bound by Hollington Boulevard to the west, Santorini Promenade to the north, a cleared area to the east, Halesworth Parade and a construction site to the south (**Figure 1-1**).

Eco Logical Australia (ELA) was commissioned by the City to undertake a Level 2 flora and Level 1 fauna survey of the study area. This information will be used to provide the City with a better understanding of the potential impacts on remnant native vegetation from the project, and to facilitate any necessary environmental and planning approvals from State and Commonwealth Governments.

## 1.2 Objectives

The objectives of the flora and fauna survey were to:

- Identify and map vegetation communities
- Determine and map vegetation condition
- Identify and map Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)
- Complete Floristic Community Type (FCT) statistical analysis to determine the occurrence of TECs and/or PECs
- Establish the occurrence, extent/distribution and populations of flora and fauna species, including conservation significant species listed under the WA *Wildlife Conservation Act 1950* (WC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Establish the extent and map weed species, including declared pest plants and weeds of national significance (WoNS)
- Identify and map any Threatened, Specially Protected, or Priority listed fauna
- Identify and map fauna habitat (including habitat trees).

## 1.3 Legislative framework

The Level 2 flora and Level 1 fauna survey has been undertaken to meet requirements under WA *Environmental Protection Act 1986* (EP Act) and the EPBC Act. The survey was also consistent with the WA Environmental Protection Authority (EPA) guidelines. Specifically, the survey has been undertaken in accordance with the following:

- EPA Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004a)
- EPA Guidance Statement No. 56 - Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b)
- EPA Position Statement No. 3 - Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002)
- EPA and Department of Environment and Conservation (DEC) Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC 2010)

- EPA and Department of Parks and Wildlife (DPaW) Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPaW 2015)
- EPBC Act referral guidelines for three Threatened Black Cockatoo species (Department of Sustainability, Environment, Water, Population and Communities (Department of Sustainability, Environment, Water, Population and Communities [SEWPAC] 2012).

Figure 1-1: Study Area Location

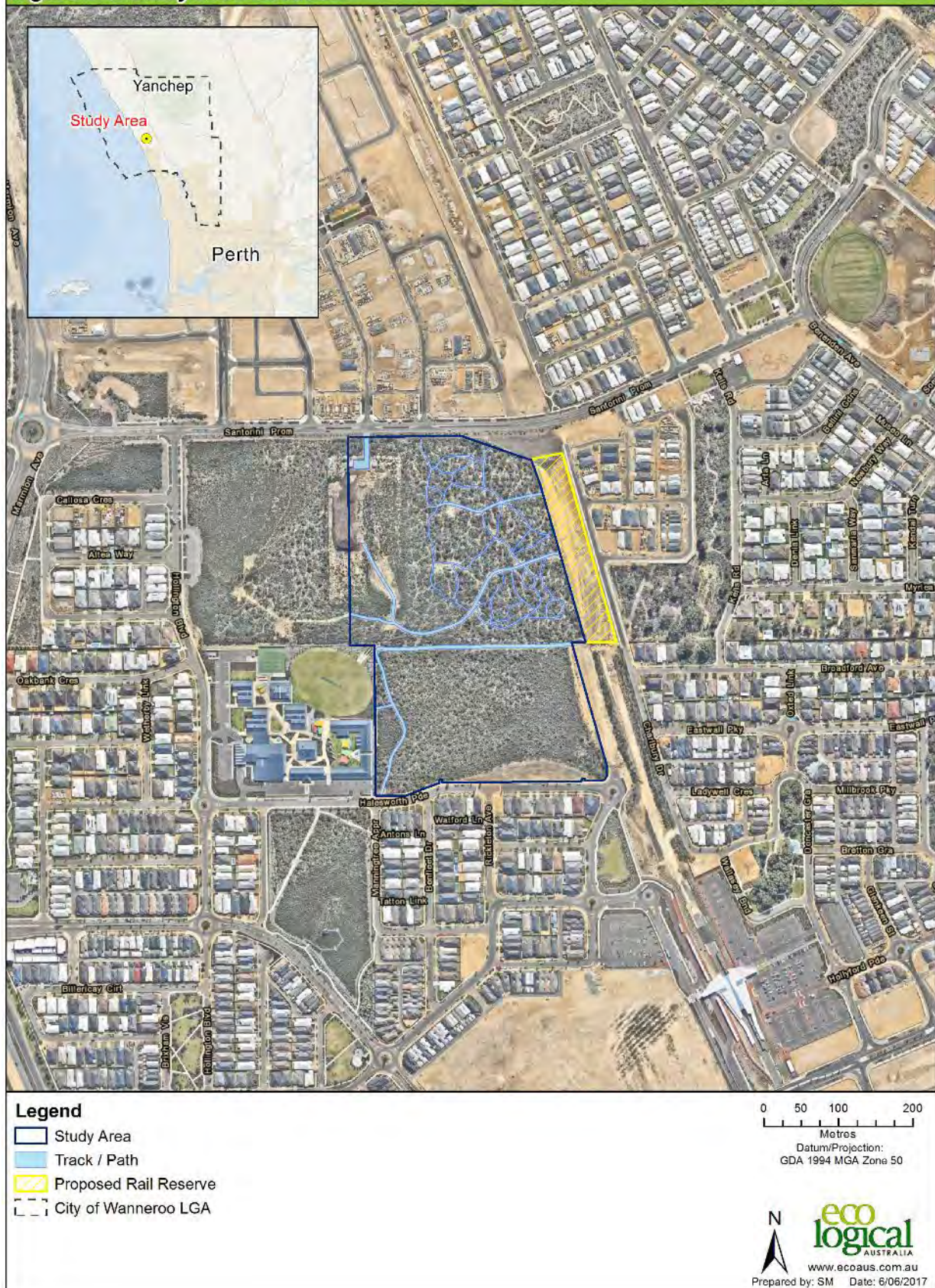


Figure 1-1: Study area location



## 2 Desktop review

### 2.1 Overview of the study area

The study area comprises approximately 13.1 ha of remnant native bushland and cleared areas. It is surrounded by housing to the north and south, is bound by a rail reserve to the east and located adjacent to the John Butler Primary College to the west (**Figure 1-1**). Lot 9038, which belongs to the Department of Education, lies adjacent to the northern section of the study area and also comprises remnant native vegetation. This portion of bushland was not included in this survey.

### 2.2 Climate

The Perth subregion experiences a warm, Mediterranean climate with hot dry summers and mild wet winters (Mitchell et al. 2002). Based on climate data from the nearby Bureau of Meteorology (BoM) Wanneroo weather station (located approximately 13 km north of the study area), the study area receives an average annual rainfall of 801.2 mm, with most rainfall occurring during the winter months of June, July and August (163.9 mm, 162.2 mm and 122.3 mm respectively) (BoM 2016). Mean maximum air temperatures experienced in the area range from 19.5°C in July to 34.6°C in February, and mean minimum temperatures range from 4.4°C in July to 21°C in February (BoM 2016).

The study area has received approximately 756.5 mm of rainfall over the past 12 months (BoM 2016; **Table 1**). In the three months prior to the field survey in November, 238.5 mm of rain was recorded, which was slightly lower than the long-term average rainfall for the same period (254.9 mm; **Table 1**).

**Table 1: Rainfall data recorded at Wanneroo weather station (009105) 12 months prior to the survey and average monthly rainfall data\***

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Total monthly rainfall 2015-16 (mm)	6.7	19.4	7.2	14.0	30.0	79.2	116.5	109.0	136.0	147.9	55.6	35.0	756.5
Average monthly rainfall (mm)	21.8	9.9	10.4	12.3	16.1	39.2	110.5	163.9	162.2	122.3	84.9	47.7	801.2

\* Data obtained from BoM (2016)

### 2.3 Landform, geology and soils

The study area comprises Tamala Limestone and Sand Derived from Tamala Limestone, and is situated on the Spearwood Dune System (Government of WA 2000).

The Spearwood Dune System consists of a limestone ridge that runs parallel to the coastline from north to south, with shallow brown / bright yellow sands covering the ridge. A number of different soils are associated with the Spearwood dune system including the Cottesloe and Karrakatta associations (Government of WA 2000). The Cottesloe association runs from north to south and consists of a series of ridges, hills and hollows characterised by shallow brown and bright yellow sand loam over limestone. The Karrakatta association consists of deep sand containing siliceous sand with limestone often in association and grey, pale yellow sand with limestone at depth. This soil type usually occurs on the

eastern side of the Cottesloe ridge. It represents the most fertile soil type in the City and supports the greatest diversity of tree species as well as being favoured for agricultural practices.

Soils comprise pale grey to pale yellow sands, limestone and associated light yellowish brown sands, silts, sands and calcareous deposits in various associations.

## 2.4 Vegetation

### 2.4.1 IBRA bioregions and subregions

The Interim Biogeographic Regionalisation for Australia (IBRA) recognises 89 bioregions (Department of the Environment [DoE] 2016a). The study area is located in the Swan Coastal Plain bioregion as defined by IBRA. The Swan Coastal Plain bioregion has been further subdivided into two subregions: Dandarragan Plateau (SWA1) and Swan Coastal Plain (SWA2). The study area falls within the Swan Coastal Plain sub-region, which is described by Mitchell et al. (2002) as:

- A low lying coastal plain, mainly covered with woodlands dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. It is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone.

### 2.4.2 Vegetation complexes

Vegetation within the Perth metropolitan area has been described by Heddle et al. (1980) as vegetation complexes. The vegetation of the study area is situated in the Aeolian deposit landform and crosses one vegetation complex: Cottesloe – Central and South Complex. This complex is described as a 'mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala*, *E. marginata*, *E. calophylla*; closed heath on the limestone outcrops' (Government of WA 2000).

Vegetation type and extent has been mapped at a regional scale by Beard (1981) who categorised vegetation into broad vegetation associations. Based on Beard's (1975) mapping at a scale of 1:1,000,000, DAFWA has compiled a list of the types and extent of vegetation associations across WA (Shepherd et al. 2002).

One broad vegetation association occurs within the study area: Low Banksia Woodland (Shepherd vegetation association 949, Beard mapping unit bLi).

The pre-European vegetation extent remaining for vegetation association 949 within the Spearwood Dune System is 51.4% (Government of WA 2015).

### 2.4.3 Floristic Community Types

The vegetation of the southern Swan Coastal Plain has been systematically surveyed and defined into Floristic Community Types (FCTs) by Gibson et al. (1994). The floristic analysis defined 30 FCTs, with some groups further subdivided and, in all, a total of 43 types and sub-types have been recognised (Gibson et al. 1994). The Spearwood Dunes unit supports FCTs 24, 25, 26a, 26b, 27 and 28. Occurrences of FCT 24 and 28 are known to occur approximately 3.0 and 2.1 km south east of the study area at Neerabup (Gibson et al. 1994).

## 2.5 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under section 51B of the EP Act. ESAs include areas declared as World Heritage, included on the National Heritage List under the EPBC Act, defined wetlands, and vegetation

containing rare (Threatened) flora, TECs and Bush Forever sites. The study area does not occur within any ESAs; however, four TECs was identified as potentially occurring within, or close to, the study area (see below). In addition, Neerabup National Park (listed on the National Heritage List) is located approximately 1.2 km to the east of the study area.

### *Threatened Ecological Communities*

One TEC was identified as potentially occurring within the study area: Banksia Woodlands of the Swan Coastal Plain (DPaW 2016a; DotEE 2016c). This TEC has recently been listed as Endangered under the EPBC Act by the Threatened Species Scientific Community (DotEE 2016c). In order to determine whether the Banksia Woodlands of the Swan Coastal Plain TEC is present in the study area, key diagnostic characteristics must be met under Section 2 of the Conservation Advice (DotEE 2016c; refer to Section 3.3.2).

A further three TECs were identified as occurring within 5 km of the study area including (**Table 2** and **Figure 2-1**; DPaW 2016a):

- Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain (listed as Critically Endangered [CR] under the EPBC Act)
- Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain (listed as CR under the EPBC Act)
- *Melaleuca huegelii* - *Melaleuca acerosa* (currently *M. systema*) shrublands on limestone ridges (listed as Endangered [EN] under the EPBC Act).

The closest recorded TEC to the study area is the '*Melaleuca huegelii* - *Melaleuca acerosa* (currently *M. systema*) shrublands on limestone ridges', the buffer of which lies approximately 875 m north-west of the study area (**Figure 2-1**). None of these TECs occur within the study area itself or are considered likely to occur.

**Table 2: Threatened Ecological Communities within the vicinity of the study area**

TEC ID	Description	Conservation status*	Closest record to the study area
Caves SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	CR	940 m north
SCP19b	Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain (Gibson et al. 1994)	CR	4.1 km north
Limestone ridges (SCP 26a)	<i>Melaleuca huegelii</i> - <i>Melaleuca acerosa</i> (currently <i>M. systema</i> ) shrublands on limestone ridges (Gibson et al. 1994 type 26a)	EN	875 m north west

## **2.6 Priority Ecological Communities**

PECs are biological flora or fauna communities that are recognised to be of significance, but do not meet the criteria for a TEC. There are five categories of PECs, none of which are currently protected under legislation (see **Appendix A**).

There are numerous occurrences of the 'Northern Spearwood shrublands and woodlands' (SCP24) Priority 3 PEC within 5 km of the study area, with the closest buffer occurring approximately 1.1 km south (**Figure 2-1**; DPaW 2016a, 2016b).

## 2.7 Database searches

The following Commonwealth and State databases were searched for information relating to conservation significant flora, fauna and ecological communities in order to summarise existing data:

- Parks and Wildlife Threatened and Priority Species and Ecological Communities Database Search (DPaW 2016a; **Appendix C**)
- Parks and Wildlife and Western Australian Museum's NatureMap online flora and fauna database (DPaW 2016c; **Appendix D**)
- Commonwealth Protected Matters Search Tool (PMST) for Threatened Species and Communities listed under the EPBC Act (DotEE 2016b; **Appendix E**).

The following databases/information sources were also used to inform the survey and likelihood of occurrence of flora, vegetation and fauna species:

- The International Union for Conservation of Nature (IUCN) red list (IUCN 2016)
- Department of Environment Regulation (DER) ESA database (DER 2016)
- Western Australian Organism List (Department of Agriculture and Food WA [DAFWA] 2016)
- Relevant Landgate databases (SLIP portal) for TECs and PECs (Government of WA 2009).

Conservation codes, categories and criteria for flora and fauna protected under the EPBC Act and WC Act are provided in **Appendix A**.

### 2.7.1 Conservation significant flora

Specific criteria were used to assess the likelihood of occurrence of conservation significant flora in the study area prior to the field survey. The likelihood of occurrence assessment was based on the species matching the criteria described in **Appendix B**.

A total of 33 conservation listed flora species were identified as possibly occurring from database searches, based on records of occurrence within a 5 km radius (**Appendix C**, **Appendix E** and **Appendix C**). Prior to the field survey, 15 species were considered to potentially occur:

- *Calectasia cyanea* - listed as Critically Endangered under both the EPBC and WC Act
- *Eucalyptus argutifolia* – listed as Vulnerable under both the EPBC and WC Act
- *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) – listed as Priority 1 (P1) by DPaW
- *Leucopogon maritimus* - listed as P1 by DPaW
- *Melaleuca* sp. Wanneroo (G.J. Keighery 16705) – listed as P1 by DPaW
- *Rinodina bischoffii* – listed as P2 by DPaW
- *Conostylis bracteata* – listed as P3 by DPaW
- *Hibbertia spicata* subsp. *Leptotheca* – listed as P3 by DPaW
- *Leucopogon* sp. Yanchep (M. Hislop 1986) - listed as P3 by DPaW
- *Pimelea calcicola* - listed as P3 by DPaW
- *Sarcozona bicarinata* – listed as P3 by DPaW
- *Stylidium maritimum* – listed as P3 by DPaW
- *Conostylis pauciflora* subsp. *euryrhipis* – listed as P4 by DPaW
- *Jacksonia sericea* – listed as P4 by DPaW
- *Lepidium pseudotasmanicum* – listed as P4 by DPaW.



The remaining six species were considered unlikely to occur. A full list of possibly occurring conservation listed flora species, including those that are considered unlikely to occur, is provided in **Appendix F**. Post field survey, the likelihood of occurrence was updated and is discussed further in Section 4.1.1.

### 2.7.2 Conservation significant fauna

Specific criteria were used to assess the likelihood of occurrence of conservation significant fauna prior to the field survey, based on the species matching the criteria described in **Appendix B**.

A total of 24 conservation significant fauna species were identified as possibly occurring from database searches, based on records of occurrence within a 5 km radius (**Appendix C**, **Appendix E** and **Appendix C**). It should be noted that a number of species were omitted from this list including pelagic mammals, sea turtles, sea birds, and locally extinct species.

Of the 24 conservation listed fauna species, one species was considered likely to occur:

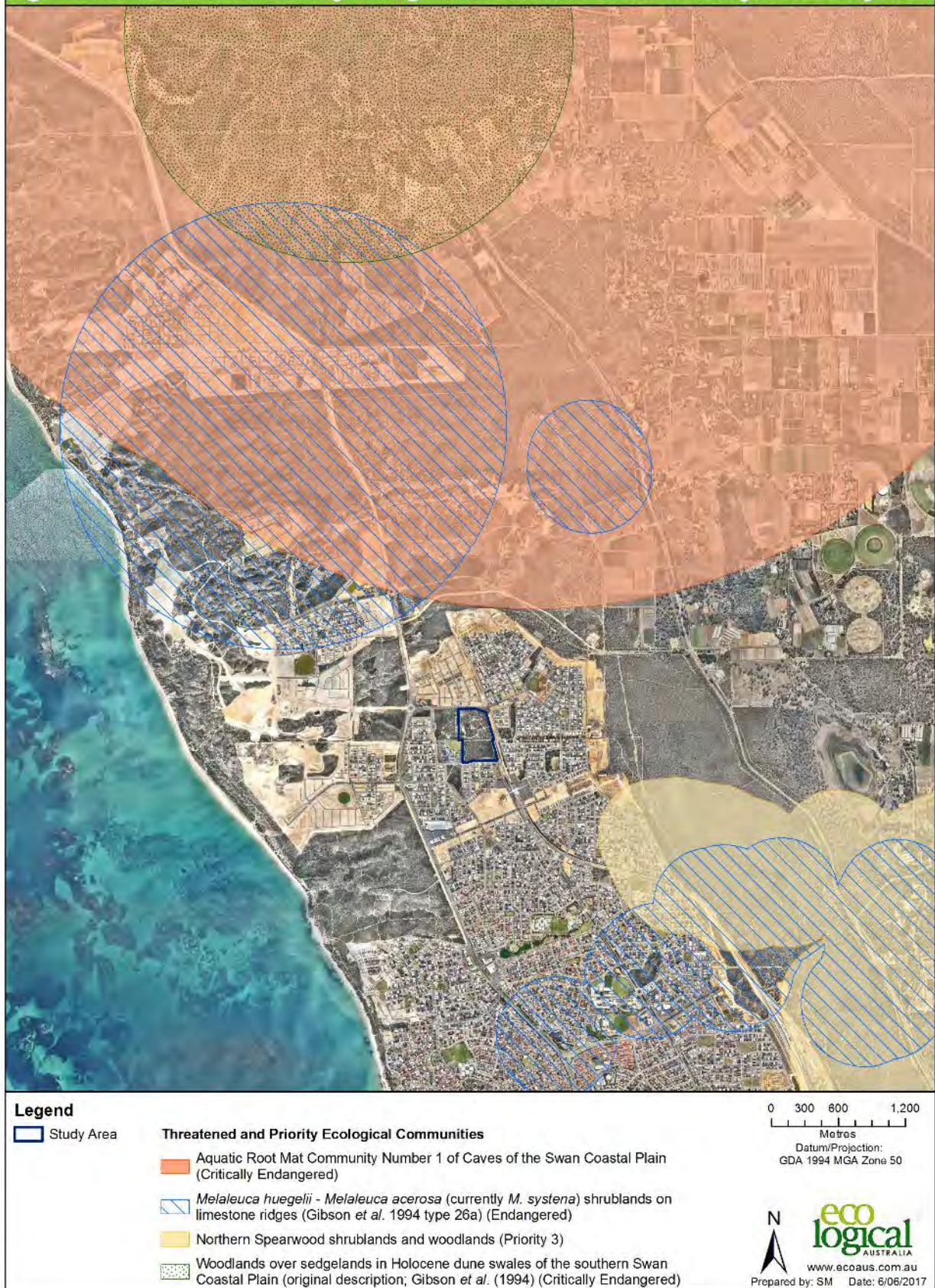
- *Calyptorhynchus latirostris* (Carnaby's Cockatoo) – listed as EN under the EPBC Act and WC Act.

A further 10 species were considered to potentially occur:

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) – listed as Vulnerable under the EPBC Act and WC Act
- *Apus pacificus* (Fork-tailed Swift) – listed as Migratory under the EPBC Act and Schedule 5 under the WC Act
- *Motacilla cinerea* (Grey Wagtail) – listed as Migratory under the EPBC Act and Schedule 5 under the WC Act
- *Pandion haliaetus* (Osprey) – listed as Migratory under the EPBC Act and Schedule 5 under the WC Act
- *Merops ornatus* (Rainbow Bee-eater) – listed as Schedule 5 under the WC Act
- *Morelia spilota* subsp. *imbricata* (Carpet Python) – listed under Schedule 7 as Other Specially Protected Fauna (OS) of the WC Act
- *Neelaps calonotos* (Black-striped Snake) – listed as Priority 3 by DPaW
- *Macropus irma* (Western Brush Wallaby) – listed as Priority 4 by DPaW
- *Synemon gratiosa* (Graceful Sun-moth) – listed as P4 by DPaW
- *Isodon obesulus fusciventer* (Quenda, southern brown bandicoot) – listed as Priority 5 by DPaW.

The remaining 13 species were considered unlikely to occur. A full list of possibly occurring conservation listed fauna species, including those that are considered unlikely to occur, is provided in **Appendix G**. Post field survey, the likelihood of occurrence was updated and is discussed further in Section 4.3.3.1.

**Figure 2 1: Threatened and Priority Ecological Communities Within Proximity to the Study Area**



**Figure 2-1: Threatened and Priority Ecological Communities within proximity to the study area**

## 3 Methodology

### 3.1 Survey team and timing

The Level 2 flora and vegetation survey was undertaken by Joel Collins (Senior Botanist) and the Level 1 fauna survey was undertaken by Nicki Thompson (Ecologist). The field surveys were undertaken on the 3<sup>rd</sup> November 2016. The timing of the surveys was optimal for these type of assessments on the Swan Coastal Plain, particularly given the late winter experienced in 2016. The survey team's relevant qualifications, experience and licences are provided in **Table 3**.

**Table 3: Survey team**

Name	Qualification	Relevant experience	Licence numbers
Flora and Vegetation Survey			
Joel Collins	BAgribus Hort (Hons)	Thirteen years' experience throughout the South West bioregions and in particular the Swan Coastal Plain.	Scientific licence: SL011816 Declared Rare Flora (DRF) permit: 14-1516
Fauna survey			
Nicki Thompson	BSc. Zoology (Hons)	Numerous Level 1 and targeted fauna surveys across Western Australia, in particular throughout the South West bioregion.	N/A

### 3.2 Survey limitations

EPA Guidance Statement No. 51 (EPA 2004a) and No. 56 (EPA 2004b) recommend including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the Level 2 flora and vegetation, and Level 1 fauna survey for the study area are summarised in **Table 4**.

**Table 4: Survey limitations of the Butler flora and fauna survey**

Factor	Limitations
Sources of information	The Northern region of the Swan Coastal Plain has been relatively well surveyed. Numerous flora and fauna surveys have been undertaken in the wider area. Database searches provide adequate information about Threatened and Priority flora and fauna, TECs and PECs.
Scope of works	The scope of works provided adequate detail to achieve the survey objectives.
Completeness of survey	The survey requirements of a Level 2 flora and Level 1 fauna survey including Black Cockatoo assessment were adequately met. Transect sampling was undertaken to effectively search for Threatened and Priority flora and fauna, and flora quadrats were established to identify vegetation communities. Habitat assessment was conducted



Factor	Limitations
	to effectively determine likelihood of occurrence of the relevant conservation significant flora and fauna species.
Intensity of survey	The survey effort was satisfactory for a Level 2 flora and Level 1 fauna survey, and considering the size and location of the study area as per EPA Guidance Statements No. 51 and 56, and SEWPaCs referral guidelines (SEWPaC 2012).
Timing, weather, season, cycle	The Level 2 flora survey was undertaken during spring when flora species are flowering and more easily detectable. The timing of the survey was appropriate for a targeted flora survey and in accordance with EPA Guidance Statement 51.
Disturbances	There were moderate indications of disturbances within the study area, including fires, human activity and weeds.
Resources	The team members that completed the surveys are suitably qualified in their respective fields to identify specimens, assess habitat, and detect species.
Accessibility	All relevant areas in the study area were easily accessed and surveyed on foot.

### 3.3 Level 2 flora and vegetation survey

The survey design was aligned with methodology outlined in EPA Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004a), and EPA and DPaW Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPaW 2015).

The number of quadrats established to describe vegetation communities was informed using aerial imagery and regional vegetation mapping. Dominant vegetation communities were described with respect to species composition, structure and overall condition. The survey involved the use of 10 m x 10 m quadrats, relevés to supplement the data obtained from the quadrats, and opportunistic sampling of species not recorded within the quadrats to inform a flora species inventory of the study area. EPA and DPaW Technical Guide states a minimum of three quadrats per vegetation community are required to be established (EPA and DPaW 2015). A quadrat is defined as an area with a marked boundary within which data are collected; they are used to record floristic presence and characterise vegetation units (EPA and DPaW 2015). A relevé is an undefined area within which data are collected; relevés are often used to collect supplementary data in addition to quadrats.

Six quadrats and two relevés were installed across the study area (**Figure 3-1, Appendix H**). Stainless steel fence droppers were used to permanently mark the north west corner of each quadrat. Photos were taken of each quadrat, from the north west corner showing the marker and quadrat tape. All quadrats and their positions were recorded via an Android tablet. Quadrat data are provided in **Appendix H**.

The following data were recorded as part of the flora and vegetation survey:

- Vegetation structure classes, cover of all species observed in quadrats and dominant species lists for each vegetation community in accordance with Keighery (1994)
- Full species inventory (angiosperm and gymnosperm) of both native and introduced species across the study area
- Vegetation condition was assessed using the Keighery (1994) vegetation condition scale for natural assessment (**Table 5**)
- Other observational data such as landform, soils, time since fire, etc.

**Table 5: Keighery (1994) vegetation condition scale for natural area assessments**

Keighery Condition Rating	Explanation
<b>Pristine</b>	Pristine or nearly so, no obvious signs of disturbance.
<b>Excellent</b>	Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species.
<b>Very Good</b>	Vegetation structure altered; obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires; the presence of some more aggressive weeds; dieback; logging; grazing
<b>Good</b>	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback; grazing.
<b>Degraded</b>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires; the presence of very aggressive weeds; partial clearing; dieback; grazing.
<b>Completely Degraded</b>	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

A targeted survey was completed within the study area for conservation listed flora, ecological communities and weeds, including:

- Threatened flora listed under the EPBC Act
- Threatened (Declared Rare) Flora listed under the latest WA Wildlife Conservation (Rare Flora) Notice
- Priority flora recognised by DPaW
- Declared pest plants under the WA Biosecurity and Agriculture Management Act 2007 (BAM Act), and Weeds of National Significance (WoNS).

The survey methodology involved personnel walking meandering transects across the study area as well as outside the study area boundary if required. The locations of the transects walked are shown in **Figure 3-1**.

In addition to point locations, the following data were collected for any conservation listed species identified in the study area:

- Number of individuals and/or percent cover (recording a range of coordinates if necessary)
- Estimates were made for groups of individuals within a 20 m radius and for large populations to record a significant area polygon
- Reproductive phase (flowering, fruiting, etc.)
- Description of dominant vegetation unit in which the species is located

- Associated dominant species
- Photograph of the plant *in situ*.

Except where specifically noted, the field survey was undertaken using an Android Nexus 7 tablet operating the ArcGIS Collector app. These units can have errors of 3-20 m (subject to availability of satellites on the day) with an average of 5 m.

### 3.3.1 FCT analysis

Species lists for each quadrat were entered into the statistical analysis package Primer (version 6.1.11). The complete dataset of Gibson et al. (1994) was entered into Primer and merged with the ELA dataset to allow comparison of all ELA quadrats against all FCT quadrats of Gibson et al. (1994). The taxonomy of each species was aligned with that used by Gibson et al. (1994) to permit direct comparison between datasets. All data were analysed using presence/absence of each species within each quadrat. Species richness (total number of species) was calculated for each quadrat.

The merged dataset was analysed using hierarchical cluster analysis (Everitt 1980). The Primer routine uses hierarchical agglomerative clustering, which takes a similarity matrix and successively fuses the samples into groups and the groups into larger clusters, starting with the highest mutual similarities then gradually lowering the similarity level at which groups are formed (Clarke and Warwick 2001). The result of hierarchical clustering is represented by a dendrogram, with the x-axis representing the full set of samples (in this case, the quadrats sampled by ELA and Gibson et al. [1994] and the y-axis defining a similarity level at which two samples or groups are considered to have fused). The purpose of this analysis was to determine whether the quadrats sampled in the study area were similar in species composition to any of those quadrats sampled by Gibson et al. (1994) and therefore similar to a FCT assigned by Gibson et al. (1994). If quadrats in the study area are similar in species composition to Gibson et al. (1994) they would be fused into a group together in the dendrogram. Hierarchical clustering was performed on similarity matrices computed using the Bray-Curtis coefficient and using the 'group average' cluster mode (refer to Clarke and Warwick [2001] for more information).

### 3.3.2 Assessing Banksia woodlands for TEC status

The 'Banksia Woodlands of the Swan Coastal Plain' TEC has recently been listed as Endangered under the EPBC Act by the Threatened Species Scientific Community (DotEE 2016c). For information to assist in referral, environmental assessment and compliance issues, it has been recommended to refer to the Listing Advice and/or Conservation Advice and Recovery Plan under the SPRAT profile (DotEE 2016c). The Listing and/or Conservation Advice defines the national ecological community and includes key diagnostic characteristics, condition thresholds and additional considerations (DotEE 2016c).

In order to determine whether the 'Banksia Woodlands of the Swan Coastal Plain' TEC is present in the study area, key diagnostic characteristics must be met under Section 2 of the Conservation Advice (DotEE 2016c).

For EPBC Act referral assessment and compliance purposes, the national ecological community is limited to patches that meet the key diagnostic characteristics (Step 1), condition thresholds (Step 2), and minimum patch sizes (Step 3).

Assessing the key diagnostic characteristics is the first step in identifying the Banksia Woodlands ecological community, acknowledging that the ecological community encompasses a number of recognised sub-communities previously assigned as FCTs (Gibson et al. 1994).

Step two involves assessing the condition threshold of the study area. Condition threshold categories describe different values and functional attributes of the ecological community and the thresholds for their

inclusion in the ecological community protected under the EPBC Act. It is recognised that any single patch of a threatened ecological community may be degraded to some degree but contributes to the overall function of the ecological community (and other environmental components) across the often fragmented landscape (DotEE 2016c).

Step three involves assessing the patch size as minimum patch sizes apply for consideration of a patch as part of the listed ecological community for EPBC Act referral, assessment and compliance purposes (DotEE 2016c). This concept recognises that even small, fragmented patches of a TEC can contribute to the overall function of the ecological community (and other environmental components) across the landscape.

Step four involves assessing further information to assist in determining the presence of the ecological community and significant impacts.

The assessment to determine whether the 'Banksia Woodlands of the Swan Coastal Plain' TEC is present in the study area is provided in Section 4.2.4.

### **3.3.3 Specimen identification and nomenclature**

Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (DPaW 2016c). Voucher specimens were collected in the field of all actual or potential conservation listed flora species. Collections were made of other species, if required, that commonly occurred in the habitat of the conservation listed species to enable correct identification. All collections were assigned a unique collecting number.

Specimen identification was undertaken by ELA Senior Botanist Joel Collins. Species identification utilised taxonomic literature and keys with all specimens confirmed using the Western Australian Herbarium (WAH) reference collection. Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, will be submitted along with Threatened and Priority Report forms to DPaW, as required by conditions of collection licences issued under the WC Act.

## **3.4 Level 1 fauna survey**

The survey design was aligned with methodology outlined in EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b), and the Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC 2010).

### **3.4.1 Fauna habitat assessment**

An assessment of fauna habitat in terms of its ability to support and sustain populations of fauna, along with an assessment of the likelihood of occurrence of conservation significant fauna species listed in Section 2.7.2 was undertaken during the survey. The habitat characteristic and fauna database records used in assessing likelihood of occurrence for fauna included:

- Vegetation community type, structure and condition
- Soil and landform type
- Extent and connectivity of bushland
- Fauna species habitat preferences
- Proximity of conservation significant fauna records
- Signs of species presence.

### **3.4.2 Black Cockatoo habitat assessment**

An assessment of Black Cockatoo habitat was undertaken in accordance with the EPBC Act referral guidelines (SEWPaC 2012). This involved assessing the extent, type and quality of the vegetation present, including the presence and extent of any plants known to be used by Black Cockatoos, either for foraging, breeding or roosting. Any tree species known to support breeding (i.e. Marri, Tuart and Jarrah) were measured for their diameter at breast height (DBH) and assessed for their potential to support hollows (SEWPaC 2012).

Prior to the survey, aerial imagery was studied to determine the vegetation communities present within the study area and their potential for providing foraging habitat for Black Cockatoos. These values were then ground-truthed during the survey to determine the extent of potential foraging habitat within the study area.

Observations were made of any Black Cockatoo foraging activity based on feeding residue such as chewed *Banksia* cones, and any Black Cockatoo individuals observed foraging within or flying over the study area.

### **3.4.3 Opportunistic fauna observations**

Opportunistic fauna sightings were an integral technique of this fauna survey. Opportunistic recordings were made at all times during the field survey. These included visual sightings of active fauna such as reptiles and birds; records of bird calls; and signs of species presence such as tracks, diggings, burrows, scats and any other signs of fauna activity.

### **3.4.4 Taxonomy and nomenclature**

Nomenclature used for the vertebrate fauna species within this report follows the WA Museum (WAM) Checklist of the Vertebrates of Western Australia (WAM 2016). Where common names were not stated for certain species, the following references were consulted:

- Amphibians and reptiles: Bush et al. (2010)
- Reptiles: Wilson and Swan (2013)
- Birds: Morcombe (2007)
- Mammals: Menkhorst and Knight (2011).



Figure 3-1: Flora and Fauna Survey Effort

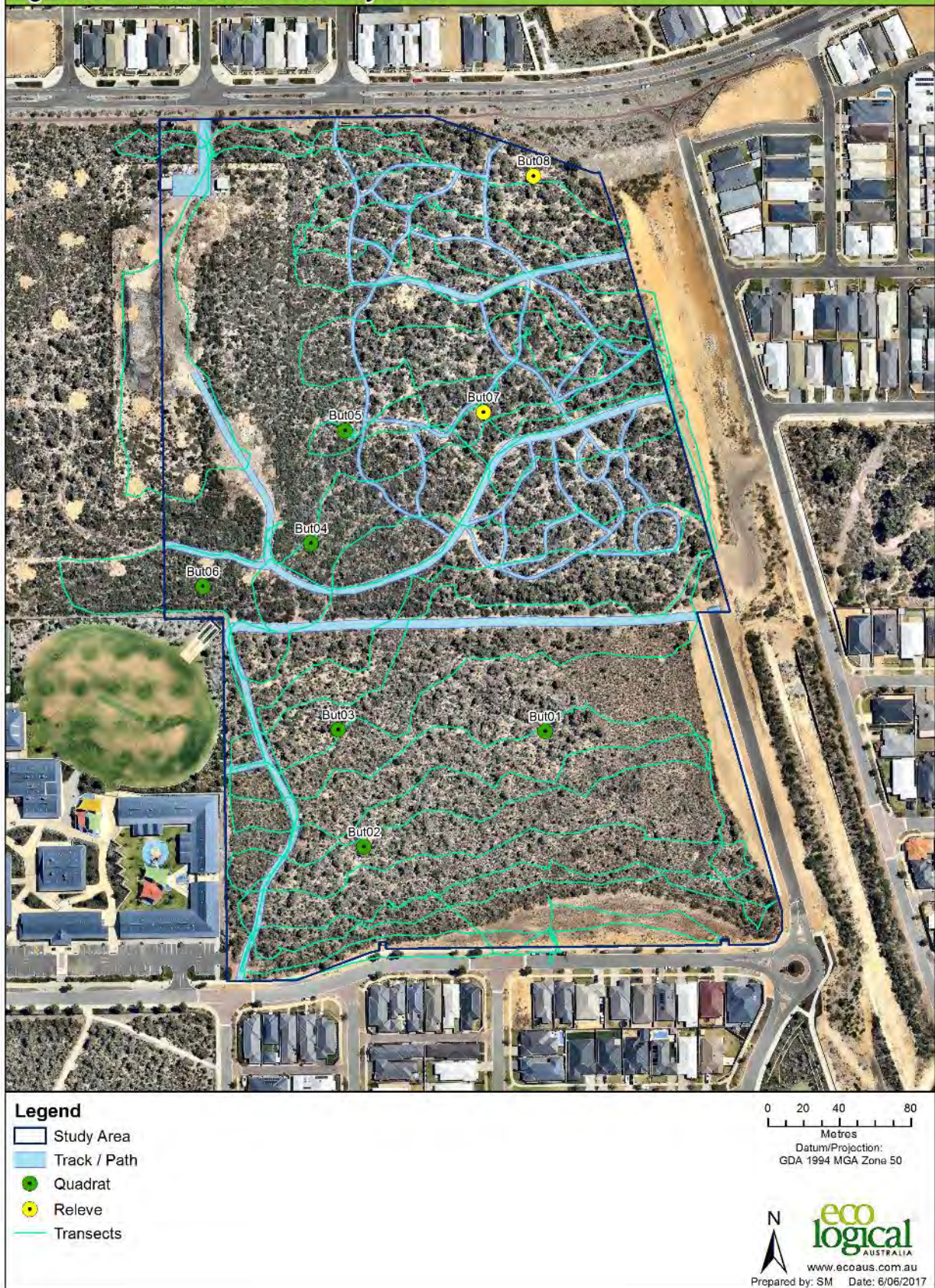


Figure 3-1: Flora and fauna survey effort



## 4 Results

### 4.1 Flora of the study area

A total of 98 flora taxa comprising 36 families and 87 genera were identified within the study area (**Appendix I**). This total included 73 (75% of the total) native and 25 (25% of the total) introduced taxa. The most commonly occurring family was Proteaceae (12 taxa) and Asteraceae (12 taxa). *Banksia* and *Hakea* (Proteaceae) were the most common genera with four and three taxa recorded respectively in the study area.

The mean native species richness for all quadrats sampled was 40.2 species per quadrat (range: 34–48 species per quadrat). The flora species matrix is provided in **Appendix J**.

A list of all flora species recorded within the study area is provided in **Appendix I** and floristic quadrat data is provided in **Appendix G**.

#### 4.1.1 Conservation significant flora

Following the field survey, the likelihood of occurrence ratings of conservation listed flora species identified in the desktop assessment were revised to provide a more accurate reflection of the possibility of these species occurring based on the current habitat and condition within the study area (**Appendix F**).

No conservation significant flora were recorded in the study area. Following the survey, the likelihood of occurrence for all the potentially occurring flora species was reduced to unlikely (**Appendix F**). This was due to the study area being well surveyed and the lack of suitable habitat for these species.

#### 4.1.2 Introduced flora

Introduced (weed) species represented a quarter of the total species recorded in the study area with a total of 25 taxa recorded. A full list of weed species recorded from the study area is included in **Appendix K**. This number of introduced species is typical for remnant vegetation in the Perth metropolitan area, with many of the species recorded in disturbed areas such as along the edge of tracks, edges of remnant vegetation and cleared/roadside areas. None of the weed species recorded represent Declared Pests or WoNS, listed under the *Biosecurity and Agriculture Management Act 2007*.

The mean introduced species richness for quadrats sampled was 11.3 species per quadrat (range: 7–16 species per quadrat).

### 4.2 Vegetation of the study area

#### 4.2.1 Vegetation communities

Two vegetation communities were recorded within the study area (**Table 6** and **Figure 4-5**).

- **BaBmLW:** *Banksia attenuata* and *Banksia menziesii* low woodland over *Xanthorrhoea*, *Hibbertia hypericoides* subsp. *hypericoides* and *Leucopogon polymorphus* open low heath over *Mesomelaena pseudostygia* very open sedgeland and *\*Briza maxima* and *\*Ehrharta calycina* very open grassland over *Burchardia congesta*, *Waitzia suaveolens* var. *suaveolens* and *Podothea gnaphalioides* very open herbland.
- **BsXpHtTOS:** *Banksia sessilis* var. *cygnorum*, *Xanthorrhoea preissii* and *Hakea trifurcata* tall open scrub over *Acacia pulchella* var. *glaberrima*, *Calothamnus quadrifidus*, *Acacia pulchella* var. *glaberrima* and *Hibbertia hypericoides* open low heath *Mesomelaena pseudostygia* and

*Desmocladius fasciculatus* very open sedgeland and *\*Briza maxima* and *Microlaena stipoides* very open grassland over *Podotheca chrysantha*, *Acanthocarpus preissii* and *Waitzia suaveolens* var. *suaveolens* very open herbland.

BaBmLW accounted for 71% of the study area, whereas BsXpHtTOS accounted for only 15% (Table 6). The remaining 14% was mapped as previously cleared and devoid of native vegetation (Figure 4-5).

A vegetation community by species matrix is provided in Appendix J. Vegetation community BaBmLW had a higher species diversity (44.6 species/quadrat) compared to BsXpHtTOS (35.7 species/quadrat).

**Table 6: Vegetation communities in the study area**

Vegetation community	Description	Quadrats	Condition	Extent within study area (ha)	Portion of study area (%)
BaBmLW	<i>Banksia attenuata</i> and <i>Banksia menziesii</i> low woodland over <i>Xanthorrhoea preissii</i> , <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> and <i>Leucopogon polymorphus</i> open low heath over <i>Mesomelaena pseudostygia</i> very open sedgeland and <i>*Briza maxima</i> and <i>*Ehrharta calycina</i> very open grassland over <i>Burchardia congesta</i> , <i>Waitzia suaveolens</i> var. <i>suaveolens</i> and <i>Podotheca gnaphalioides</i> very open herbland.	But01, But02, But03, Releves: But07 and But08	Excellent to Degraded	9.29	70.97
BsXpHtTOS	<i>Banksia sessilis</i> var. <i>cygnorum</i> , <i>Xanthorrhoea preissii</i> and <i>Hakea trifurcata</i> tall open scrub over <i>Acacia pulchella</i> var. <i>glaberrima</i> , <i>Calothamnus quadrifidus</i> , <i>Acacia pulchella</i> var. <i>glaberrima</i> and <i>Hibbertia hypericoides</i> open low heath <i>Mesomelaena pseudostygia</i> and <i>Desmocladius fasciculatus</i> very open sedgeland and <i>*Briza maxima</i> and <i>Microlaena stipoides</i> very open grassland over <i>Podotheca chrysantha</i> , <i>Acanthocarpus preissii</i> and <i>Waitzia suaveolens</i> var. <i>suaveolens</i> very open herbland.	But04 But05 But07	Excellent to Good	1.96	14.97
Previously cleared, tracks and infrastructure	Previously cleared land, tracks and paths		No condition to Completely Degraded	1.84	14.06
<b>Total</b>				<b>13.09</b>	<b>100</b>

#### 4.2.2 Vegetation condition

Vegetation condition within the study area ranged from Excellent to Completely Degraded (**Table 7** and **Figure 4-6**). A total of 42.09% of the vegetation in the study area was in Excellent condition and 27.64% in Very Good condition. Small areas of Good, Degraded and Completely Degraded areas were also observed, primarily along tracks and the edges of the study area (**Table 7** and **Figure 4-6**).

**Table 7: Vegetation condition within the study area**

Vegetation condition	Total area (ha)	Portion of study area (%)
Pristine	0.0	0.0
Excellent	5.51	42.09
Very Good	3.61	27.58
Good	0.86	6.57
Degraded	1.02	7.79
Completely Degraded	1.20	9.17
Tracks/paths/ infrastructure	0.89	6.80
<b>Total</b>	<b>13.09</b>	<b>100.0</b>

The majority of vegetation community BaBmLW was either in Excellent condition (4.92 ha), or Very Good condition (3.46 ha; **Table 8**). Areas in Good (0.66 ha) or Degraded (0.24 ha) condition were associated with tracks and paths, or in areas adjacent to roads (**Figure 4-6**).

The majority of vegetation community BsXpHtTOS was in Degraded condition (0.78 ha) or Excellent condition (0.59 ha). Smaller areas were in Completely Degraded (0.25 ha), Good (0.19 ha), Very Good (0.15 ha) condition (**Table 8**). Areas in lower condition were in close proximity to the cleared area of private property on the western boundary of the study area (**Figure 4-6**).

The largest source of disturbance was rubbish dumping which was evident throughout the study area. In addition, there were numerous locations where grass trees (*Xanthorrhoea preissii*) had been removed, leaving behind large open depressions. These areas often had vehicle tracks adjacent to them which had impacted some of the surrounding vegetation. This was most evident in the northern part of the study area, where multiple tracks are visible.

Weeds were also a large source of disturbance, particularly around the roads and adjacent clearings/developed areas and tracks. European Wild Rabbit diggings/scats were evident throughout the study area and a Red Fox den was observed within a dumped vehicle at the central western corner of the study area.

**Table 8: Vegetation condition of each vegetation community**

Vegetation community	Condition (ha)							Total (ha)
	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded	Tracks/ infrastructure	
BaBmLW		4.92	3.46	0.66	0.24			9.29
BsXpHtTOS		0.59	0.15	0.19	0.78	0.25		1.96
Previously cleared						0.95		0.95
Tracks/ infrastructure							0.89	0.89
<b>Total</b>	0	5.51	3.61	0.86	1.02	1.20	0.89	13.09

#### 4.2.3 FCT analysis

Results of the cluster analysis indicated that the ELA quadrats established in the study area clustered together into two separate groupings with various high similarities to each other. The first group contained BUT\_01, BUT\_02 and BUT\_03, with BUT\_02 and BUT\_03 the most similar at 83% and BUT\_01 joined at 72%. These ELA quadrats joined two Gibson et al. (1994) quadrats; NEER\_8 and YAN\_4 at 55% similarity, with both of these quadrats classed as FCT 28 (**Figure 4-1** and **Figure 4-2**). FCT 28 is described as “Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands” (Gibson et al. 1994 and Government of WA 2000). Two additional Gibson et al. (1994) quadrats; YAN\_8 and YAN\_9 also joined this group at 41% similarity, both of which also represent FCT 28.

FCT 28 is largely restricted to the Spearwood landform and has been recorded from Thompson’s Lake north to Seabird. Species richness averages for FCT 28 is 55.2 species/quadrat and average weed frequency is high at eight species/quadrat (Gibson et al. 1994). The ELA quadrats recorded an average of 45 species/quadrat, including an average of 14.6 weed species per quadrat. The ELA quadrats recorded the typical species that represent FCT 28 (known to occur in >75% of Gibson et al. [1994] quadrats), which are *Banksia attenuata*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *\*Hypochaeris glabra*, *Burchardia congesta*, *Drosera erythrorhiza*, *Desmocladius flexuosa*, *Mesomelaena pseudostygia* and *Trachymene pilosa* (Gibson et al. 1994).

FCT 28 “Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands” has recently been listed as a TEC under the Commonwealth EPBC Act (refer to Section 4.2.3 below; DotEE 2016c). However, it is not currently listed under State legislation (DPaW 2016a, 2016b).

The second group contained BUT\_04, BUT\_05 and BUT\_06, with BUT\_05 and BUT\_06 the most similar at 79% and BUT\_04 joined at 78%. These ELA quadrats joined five Gibson et al. (1994) quadrats; firstly, with NAVB\_3 at 33% similarity and then a group of four quadrats; PTWALT\_1, BOLD\_3, BOLD\_4 and TRIG\_ at 35% similarity (**Figure 4-3** and **Figure 4-4**). All of these Gibson et al. (1994) quadrats, except PTWALT\_1, are classed as FCT 24. PTWALT\_1 is classed as FCT 10.

FCT 24 is described as “Northern Spearwood shrublands and woodlands” (Gibson et al. 1994). FCT 24 are heaths or heaths with scattered *Eucalyptus gomphocephala* on deeper soils north from Woodman’s Point. FCT 24 heathland sites also typically have *Banksia sessilis* present. Species richness averages for FCT 28 is 38.9 species/quadrat and average weed frequency of 14.2 species/quadrat (Gibson et al. 1994). The ELA quadrats recorded the typical species that represent FCT 24 (known to occur in >75% and 50-75% of all Gibson et al. [1994] quadrats), which are *Melaleuca systema*, *Desmocladius flexuosa*, *Xanthorrhoea preissii*, *Conostylis aculeata*, *Lomandra maritima* and *Austrostipa flavescens* (Gibson et al. 1994). FCT 24 “Northern Spearwood shrublands and woodlands” is currently listed as a Priority 3 PEC (DPaW 2016a, 2016b).

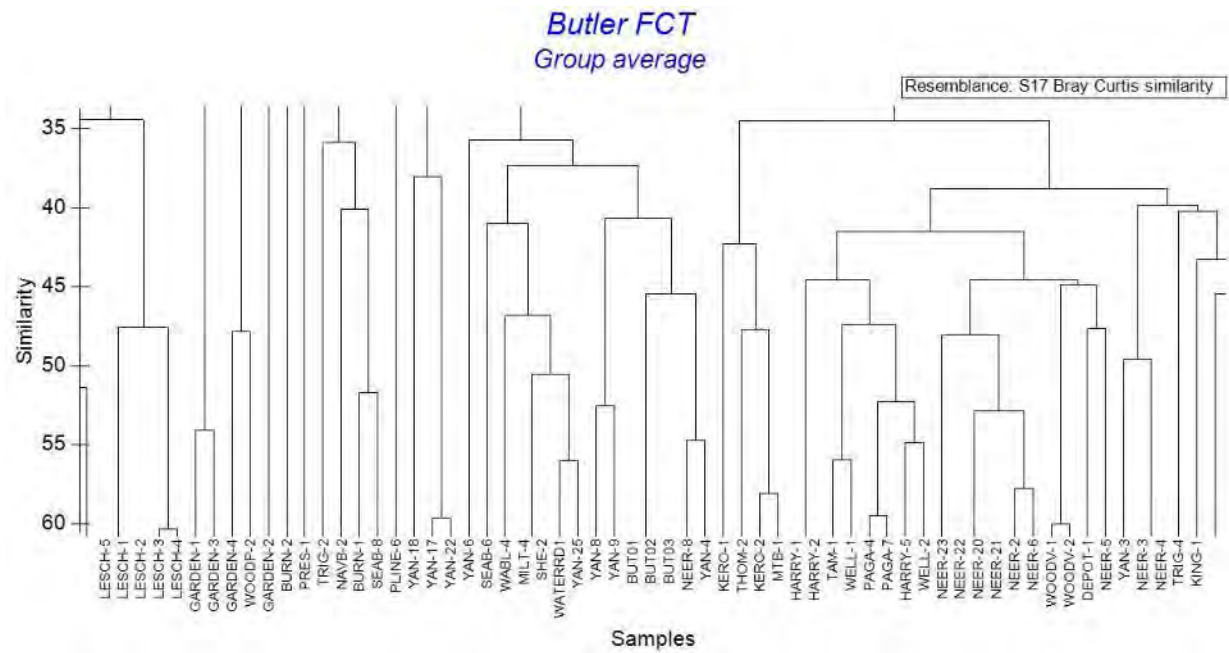


Figure 4-1: Dendrogram displaying ELA quadrats grouping with Gibson et al. (1994) quadrats (FCT 28)

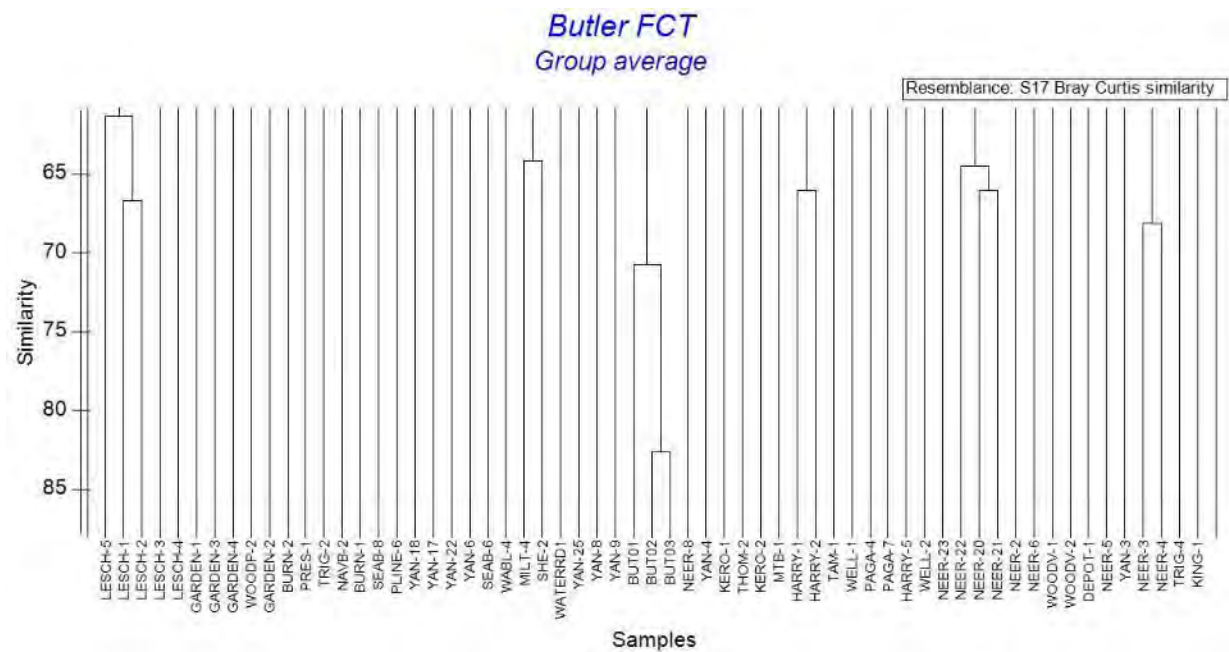


Figure 4-2: Dendrogram displaying ELA quadrats grouping with Gibson et al. (1994) quadrats (FCT 28)

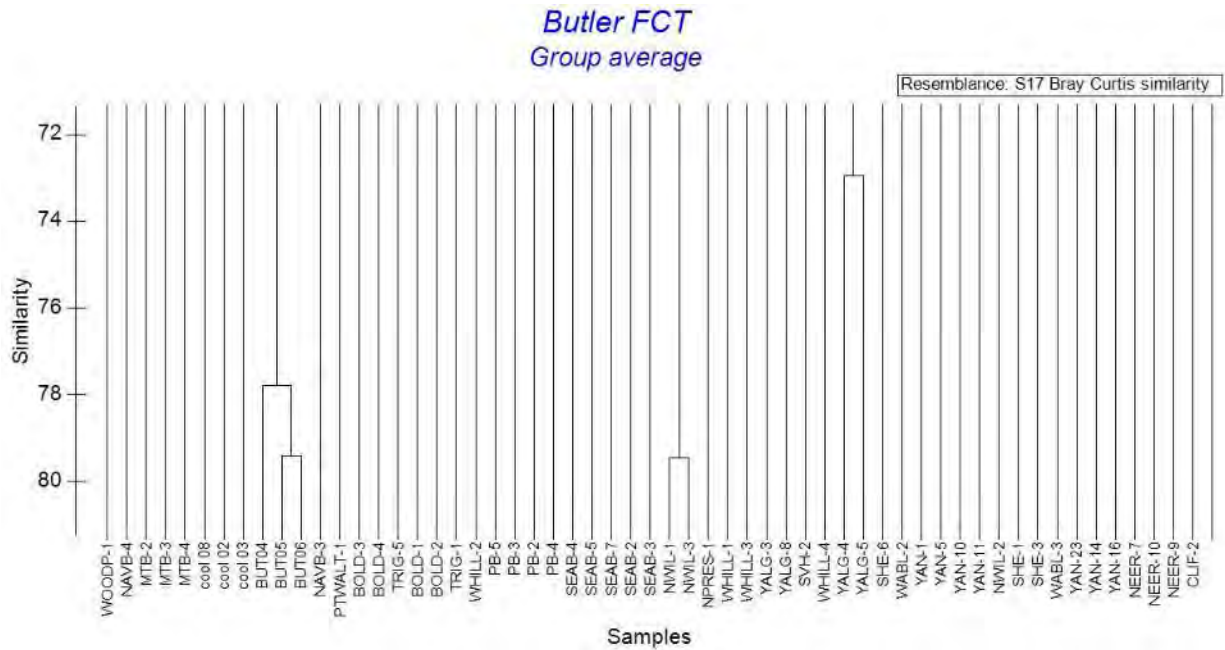


Figure 4-3: Dendrogram displaying ELA quadrats grouping with Gibson et al. (1994) quadrats (FCT 24)

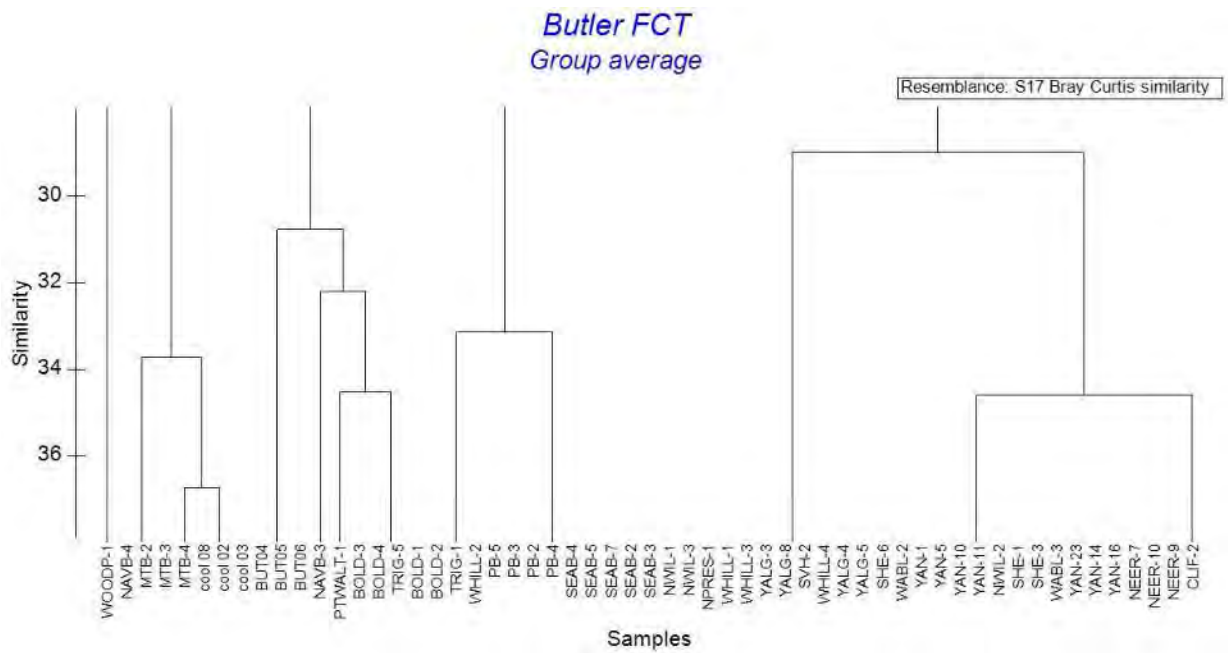


Figure 4-4: Dendrogram displaying ELA quadrats grouping with Gibson et al. (1994) quadrats (FCT 24)

#### 4.2.4 TECs and PECs

##### TECs

Within the study area, the BaBmLW: *Banksia attenuata* and *Banksia menziesii* low woodland vegetation community requires assessment to determine if it represents the TEC 'Banksia Woodlands of the Swan Coastal Plain'.

The vegetation community BsXpHtTOS is not included in this diagnostic assessment as the community lacks the key indicator species, *B. attenuata* and *B. menziesii*, and therefore is not considered to be representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC (DotEE 2016c).

Following Steps 1-4 (described in Section 3.3.2), the vegetation community BaBmLW has been assessed as likely to represent the 'Banksia Woodlands of the Swan Coastal Plain' TEC as it meets all three criteria (DotEE 2016c; **Table 9**):

- Step 1 - Located on the Swan Coastal Plain, on the Spearwood Dune system, and consists of a low woodland dominated by the key diagnostic species: *Banksia attenuata* and *Banksia menziesii*.
- Step 2 - Represents vegetation in Excellent condition:
  - Vegetation structure intact
  - Disturbance only affecting individual species
  - Weeds are non-aggressive species
  - High native plant species.
- Step 3 – represents a minimum patch size of 0.5 ha of vegetation in Excellent condition (note: must be at least 2 ha in Good condition) when considered in isolation from surrounding vegetation. The total patch for vegetation community BaBmLW in the study area totalled 9.29 ha. This vegetation is considered to extend into the adjacent lot and potentially be representative of the TEC.
- Step 4 - The patch of Banksia woodlands on the Swan Coastal Plain TEC is likely contribute to the overall function of the ecological community across the landscape as it is likely to enable the movement of native fauna and plant material to nearby patches such as Neerabup National Park.

##### PECs

There is one PEC inferred to be present within the study area: FCT 24 'Northern Spearwood shrublands and woodlands'. This PEC is currently listed as Priority 3 (DPaW 2016a, 2016b). This PEC is represented by vegetation community BsXpHtTOS, which occurs mainly in the western portion of the study area, in and around the private property (**Figure 4-5**).



**Table 9: Assessment of the Banksia woodland within the study area for TEC status**

Step	Key diagnostic characteristics (DotEE 2016c)	Outcome
1	<b>Location and physical environment</b> The Banksia Woodlands ecological community primarily occurs in the Swan Coastal Plain IBRA bioregion	Yes – the study area is located on the Swan Coastal Plain
	<b>Soil and landform</b> The Banksia Woodlands typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands	Yes – the study area is located on Spearwood Dune System
	<b>Structure</b> The structure of the Banksia Woodlands is a low woodland to forest with these features: <ul style="list-style-type: none"> <li>A distinctive upper sclerophyllous layer of low trees* (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the Banksia species identified under composition</li> <li>Emergent trees of medium or tall (&gt;10 m) height <i>Eucalyptus</i> or <i>Allocasuarina</i> species may sometimes be present above the Banksia canopy</li> <li>An often highly species-rich understorey that consists of: <ul style="list-style-type: none"> <li>a layer of sclerophyllous shrubs of various heights; and,</li> <li>a herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.</li> </ul> </li> </ul>	The vegetation community BaBmLW consists of a Low Woodland dominated by the key diagnostic species <i>Banksia attenuata</i> and <i>Banksia menziesii</i> . The community has a highly species-rich understorey that consists of a layer of sclerophyllous shrubs of various heights, and an herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. Refer to <b>Appendix J</b> for the site by species matrix.
	<b>Composition</b> <ul style="list-style-type: none"> <li>The canopy is most commonly dominated or co-dominated by <i>Banksia attenuata</i> (candlestick banksia, slender banksia) and/or <i>B. menziesii</i> (firewood banksia). Other Banksia species that dominate in some examples of the ecological community are <i>B. prionotes</i> (acorn banksia) or <i>B. ilicifolia</i> (holly-leaved banksia); and</li> <li>The patch must include at least one of the following diagnostic species: <ul style="list-style-type: none"> <li><i>Banksia attenuata</i> (candlestick banksia)</li> </ul> </li> </ul>	The canopy is dominated by the diagnostic species <i>Banksia attenuata</i> and <i>Banksia menziesii</i> . There is the presence of other codominant species, such as <i>Nuytsia floribunda</i> . The community has a high diversity of shrubs and herb species with many indicator species recorded. Refer to <b>Appendix J</b> for the site by species matrix. The contra-indicators of <i>Banksia littoralis</i> and <i>Banksia burdettii</i> were not recorded. The community

Step	Key diagnostic characteristics (DotEE 2016c)	Outcome
	<ul style="list-style-type: none"> <li>○ <i>Banksia menziesii</i> (firewood banksia)</li> <li>○ <i>Banksia prionotes</i> (acorn banksia)</li> <li>○ <i>Banksia ilicifolia</i> (holly-leaved banksia).</li> <li>• If present, the emergent tree layer often includes <i>Corymbia calophylla</i> (marri), <i>E. marginata</i> (jarrah), or less commonly <i>Eucalyptus gomphocephala</i> (tuart); and</li> <li>• Other trees of a medium height that may be present, and may be codominant with the Banksia species across a patch, include <i>Eucalyptus todtiana</i> (blackbutt, pricklybark), <i>Nuytsia floribunda</i> (Western Australian Christmas tree), <i>Allocasuarina fraseriana</i> (western sheoak), <i>Callitris arenaria</i> (sandplain cypress), <i>Callitris pyramidalis</i> (swamp cypress) and <i>Xylomelum occidentale</i> (woody pear); and</li> <li>• The understorey typically contains a high to very high diversity of shrub and herb species that often vary from patch to patch***</li> <li>• Contra-indicators: <ul style="list-style-type: none"> <li>○ Patches clearly dominated by <i>Banksia littoralis</i> are not part of the Banksia Woodlands ecological community but indicates a different, dampland community is present.</li> <li>○ Patches clearly dominated by <i>Bankia burdettii</i> are not part of the Banksia Woodlands ecological community but indicates a tall shrubland and not the Banksia Woodlands ecological community.</li> <li>○ FCT 20c – Eastern shrublands and woodlands, corresponds with a separate EPBC ecological community listing, Shrublands and Woodlands of the eastern Swan Coastal Plain. Occurrences of this FCT should be considered under that separate listing.</li> </ul> </li> </ul>	<p>does not represent FCT 20c – Eastern shrublands and woodlands.</p>
2	<p><b>Condition thresholds</b></p> <ul style="list-style-type: none"> <li>• Assessments of a patch should initially be centered on the area of highest native floristic diversity and/or cover, i.e. the best condition area of the patch.</li> <li>• Consideration must be given to the timing of surveys and recent disturbance. Ideally surveys should be undertaken in spring with two sampling periods to capture early and late flowering species.</li> </ul>	<p>The community was assessed and sampled in the highest condition representation available in the study area. The survey was completed in Spring, which is the most appropriate season to survey on the Swan Coastal Plain. The community has been determined to represent the FCT 28 Spearwood <i>Banksia attenuata</i> or <i>Banksia attenuata</i> - Eucalyptus woodlands (Gibson et</p>

Step	Key diagnostic characteristics (DotEE 2016c)	Outcome
	<ul style="list-style-type: none"> <li>The surrounding context of a patch must also be taken into account when considering factors that add to the importance of a patch that meets the condition thresholds.</li> <li>Certain vegetation components of the Banksia Woodlands ecological community merit consideration as critical elements to protect. Three components are recognised as threatened in their own right in WA and, as such, are priorities for protection; refer to Table 1 in the Approved Conservation Advice (DotEE 2016c).</li> <li>A relevant expert (e.g. ecological consultant, local NRM or environment agency) may be useful to help identify the ecological community and its condition.</li> </ul>	al. 1994). FCT 28 forms part of the Banksia Woodlands ecological community listing (DotEE 2016c).
3	<p><b>Minimum patch size</b></p> <p>Minimum patch sizes apply for consideration of a patch as part of the listed ecological community for EPBC Act referral, assessment and compliance purposes. Where patches meet different levels of condition, different minimum patch sizes apply:</p> <ul style="list-style-type: none"> <li>'Pristine' – no minimum patch size applies</li> <li>'Excellent' – 0.5 ha or 5,000 m<sup>2</sup> (e.g. 50 m x 100 m)</li> <li>'Very Good' – 1 ha or 10,000 m<sup>2</sup> (e.g. 100 m x 100 m)</li> <li>'Good' – 2 ha or 20,000 m<sup>2</sup> (e.g. 200 m x 100 m).</li> </ul> <p>Note: To be considered as part of the EPBC Act ecological community, a patch should meet at least the Good Condition category.</p>	<p>The areas of vegetation community BaBmLW are presented in <b>Table 8</b>. The community within the study area covered a total of 9.29 ha and was made up of 4.92 ha of Excellent condition and 3.46 ha of Very Good condition. The community within the study area therefore meets the condition requirements of a minimum of 0.5 ha of Excellent condition when considered in isolation from surrounding vegetation.</p> <p>The vegetation community is likely to make significant contributions to conservation, particularly in parts of the distribution where the community is very highly fragmented. This concept recognises that any single patch of a threatened ecological community may be degraded to some degree but contributes to the overall function of the ecological community (and other environmental components) across the landscape.</p>
4	<p><b>Further information to assist in determining the presence of the ecological community and significant impacts.</b></p> <ul style="list-style-type: none"> <li>The landscape position of the patch, including its position relative to surrounding vegetation also influences how important it is in the broader landscape. For example, if it enables movement of native fauna or plant material or supports other ecological processes</li> </ul>	The vegetation community BaBmLW within the study area represents a separate patch of the Banksia Woodlands of the Swan Coastal Plain TEC. There are gaps (firebreaks and roads) between nearby occurrences of the TEC (i.e. at Neerabup National Park) and the vegetation communities within the study

Step	Key diagnostic characteristics (DotEE 2016c)	Outcome
	<ul style="list-style-type: none"> <li>• A patch is a discrete and mostly continuous area of the ecological community. A patch may include small-scale (&lt;30 m) variations, gaps and disturbances, such as tracks, paths or breaks. Where there is a break in native vegetation cover, from the edge of the tree canopy of 30 m or more (e.g. due to permanent artificial structures, wide roads or other barriers; or due to water bodies typically more than 30m wide) then the gap typically indicates that separate patches are present.</li> <li>• Variation in canopy cover, quality or condition of vegetation across a patch should not initially be considered to be evidence of multiple patches. Patches can be spatially variable and are often characterised by one or more areas within a patch that meet the key diagnostic characteristics and condition threshold criteria amongst areas of lower condition. Average canopy cover and quality across the broadest area that meets the general description of the ecological community should be used initially in determining overall canopy cover and vegetation condition. Also note any areas that are either significantly higher or lower in quality, gaps in canopy cover and the condition categories that would apply across different parts of the site respectively. Where the average canopy cover or quality falls below the minimum thresholds, the next largest area or areas that meet key diagnostics (including minimum canopy cover requirements) and minimum condition thresholds should be specified and protected. This may result in multiple patches being identified within the overall area first considered.</li> <li>• A buffer zone is a contiguous area immediately adjacent to a patch of the ecological community that is important for protecting its integrity. The purpose of the buffer zone is to help protect and manage the national threatened ecological community. The edges of a patch are considered particularly susceptible to disturbance and the presence of a buffer zone is intended to act as a barrier to further direct disturbance.</li> <li>• The recommended minimum buffer zone for the ecological community is 20–50 metres from the outer edge of a patch, and the appropriate size depends on the nature of the buffer and local context (e.g. slope). A larger buffer zone should be applied, where practical, to protect patches that are of particularly high conservation value, or if patches are down slope of drainage lines or a source of nutrient enrichment, or groundwater drawdown.</li> </ul>	<p>area, that are greater than 30 m wide and so therefore must be considered a separate isolated patch.</p> <p>It is likely that the vegetation community BaBmLW represents a separate patch of the TEC and is likely to contribute to the overall function of the ecological community across the landscape.</p>

\* The term 'woodland' has been chosen as the most typical structure, but the ecological community may also be considered to include examples of shrubland, open woodland or forest under some classification systems. The percentage canopy cover is more than 2% and typically less than 50%. The structure and appearance may also vary due to disturbance history. Similarly, component species of the dominant upper sclerophyllous layer may be variously considered 'tall or large shrubs' or 'small trees'.

\*\* Refers to relevant *Banksia* species typically being amongst the most common plant species in the upper sclerophyllous layer. There may be localised exceptions to this, either as natural variation or due to disturbance history (e.g. fire).

\*\*\* Key species in the sclerophyllous shrub layer of the ecological community include members of the families Asteraceae, Dilleniaceae, Ericaceae, Fabaceae, Myrtaceae and Proteaceae. Widespread species include *Adenanthos cygnorum* (woolly bush), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Conostephium pendulum* (pearl flower), *Daviesia* spp., *Eremaea pauciflora*, *Gompholobium tomentosum* (hairy yellow pea), *Hibbertia hypericoides* (yellow buttercups), *Jacksonia* spp., *Kunzea glabrescens*, *Petrophile linearis* (pixie mops), *Philotheca spicata* (pepper and salt), *Stirlingia latifolia* (blueboy), *Phlebocarya ciliata*, *Hypolaena exsulca* and *Xanthorrhoea preissii* (balga). Key species in the herbaceous ground layer include members of the families Cyperaceae, Droseraceae, Haemodoraceae, Orchidaceae, Restionaceae and "lilies" from various families. Widespread species include *Amphipogon turbinatus* (tufted beard grass), *Burchardia congesta* (milkmaids), *Caladenia* spp. (spider orchids), *Dasypogon bromeliifolius* (pineapple bush), *Desmocladius flexuosus*, *Drosera erythrorhiza* (red ink sun dew), *Lepidosperma squamatum* (a tufted sedge), *Lomandra hermaphrodita*, *Lyginia barbata* (southern rush), *Lyginia imberbis*, *Mesomelaena pseudostygia* (semaphore sedge), *Patersonia occidentalis* (purple flag), *Podolepis* spp., *Stylidium brunonianum* (pink fountain trigger plant), *Stylidium piliferum* (common butterfly trigger plant), *Trachymene pilosa* (dwarf parsnip), and *Xanthosia huegelii* (heath xanthosia).



**Figure 4-5: Vegetation Communities**



**Figure 4-5: Vegetation communities**





**Figure 4-6: Vegetation condition of the study area**

## 4.3 Fauna

### 4.3.1 Fauna habitats of the study area

The study area contains two vegetation communities (refer to Section 4.2.1). These vegetation communities can be classed into one broad fauna habitat type: mixed *Banksia* woodland and shrubland.

The mixed *Banksia* woodland and shrubland habitat provides foraging and nesting habitat for a range of woodland birds, including honeyeaters and insectivorous species, as well as habitat for terrestrial and fossorial reptiles and some native mammals. It also provides foraging habitat for Threatened Black Cockatoos and birds of prey, such as the Nankeen Kestrel and Whistling Kite.

### 4.3.2 Black Cockatoo habitat assessment

The fauna habitat of the study area provides quality foraging habitat for Black Cockatoos in the form of proteaceous heath/woodland.

Approximately 11.25 ha of vegetation within the study area represents suitable foraging habitat for Black Cockatoos and occurs within both vegetation communities: BaBmLW and BsXpHtTOS (**Figure 4-7**). Proteaceous plants such as *Banksia* and *Hakea* species represent primary foraging species for Black Cockatoos and occur through the majority of the study area.

Evidence of Carnaby's Cockatoo foraging was observed in the form of chewed *Banksia* cones at several locations across the study area (**Figure 4-7** and **Appendix N**). Based on this and the presence of quality foraging habitat, it is considered likely that Carnaby's Cockatoo utilises the study area for foraging. In addition, the Forest Red-tailed Black Cockatoo could potentially occur in the study area on at least a transient basis given its recent expansion down onto the Swan Coastal Plain (Johnstone et. al. 2013); however the habitat is not considered preferred foraging habitat for the species (SEWPac 2012).

No suitable roosting or breeding habitat for Black Cockatoos was recorded within the study area.

### 4.3.3 Fauna species

A total of 17 vertebrate fauna species were recorded opportunistically within the study area during the Level 1 fauna survey. This comprised one reptile, 13 birds and three mammals (one native and two introduced; **Appendix L** and **Appendix M**). No amphibians were recorded during the survey.

#### 4.3.3.1 Conservation significant fauna

No fauna listed as Threatened were observed during the survey, however, Carnaby's Cockatoo foraging evidence was recorded at several locations across the study area and therefore this species is considered to occur within the study area (Section 4.3.2 and **Figure 4-7**).

One species, listed as Schedule 5 (Migratory) under the WC Act, was recorded during the survey: *Merops ornatus* (Rainbow Bee-eater). The species was observed flying around the study area, and burrows (nests) were observed in the sand quarry (rail reserve) on the eastern boundary of the study area (**Appendix M**).

Following the field survey, the likelihood of occurrence ratings of conservation listed fauna species identified in the desktop assessment were revised to provide a more accurate reflection of the possibility of these species occurring based on the current habitat and condition within the study area (**Appendix G**).

Based on this, six conservation significant species were considered to potentially occur:

- Red-tailed Black Cockatoo
- Fork-tailed Swift
- Grey Wagtail
- Carpet Python
- Black-striped Snake
- Graceful Sun-moth.

The remaining conservation listed species identified during the database searches were re-assessed as unlikely to occur due to the lack of suitable habitat (**Appendix G**).

#### 4.3.3.2 Other fauna species

##### *Amphibians*

No amphibians were recorded during the survey. Conditions during the fauna survey were considered too dry for amphibians to be recorded.

##### *Reptiles*

One reptile species was recorded during the survey: *Tiliqua rugosa* subsp. *rugosa* (Bobtail). This species is not conservation significant and is considered common and widespread throughout the Perth region and wider South West.

##### *Birds*

Thirteen bird species were recorded during the survey (**Appendix L**). Most of the recorded species are widespread throughout the South West of WA and considered common on the northern Swan Coastal Plain. They include a range of seasonal and resident nectar feeders such as honey eaters and wattle birds, opportunistic insectivores such as the Rainbow Bee-eater, as well as raptors such as *Haliastur sphenurus* (Whistling Kite), and *Falco cenchroides* (Nankeen Kestrel).

##### *Mammals*

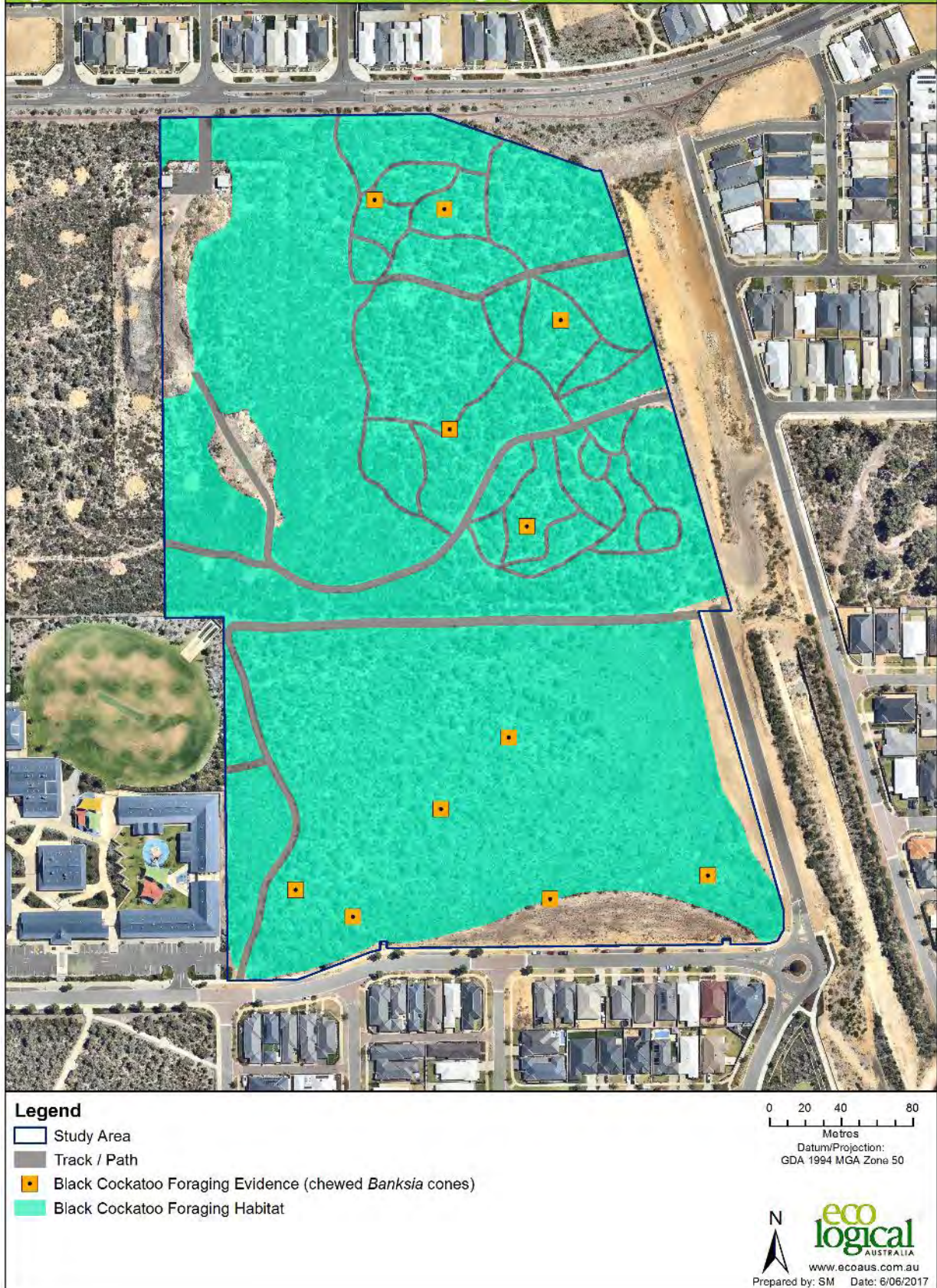
One native mammal was recorded on site via direct observation: *Macropus fuliginosus* (Western Grey Kangaroo). A large number of scats were observed throughout the study area suggesting that several individuals are likely to be present.

##### *Introduced fauna*

One introduced bird species was directly observed: *\*Streptopelia senegalensis* (Laughing Turtle-dove). Evidence of two introduced mammal species, *Oryctolagus cuniculus* (Rabbit) and *Vulpes vulpes* (European Red Fox), were recorded in the form of scats, skeletal remains and dens, at several locations within the study area (**Appendix M**).



**Figure 4-7: Black Cockatoo Habitat and Foraging Evidence Locations**



**Figure 4-7: Black Cockatoo habitat and foraging evidence locations**

## 5 Discussion

### 5.1 Flora and vegetation

The vegetation of the study area crosses one vegetation complex: Cottesloe – Central and South Complex. This complex is described as a mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala*, *E. marginata*, *E. calophylla*; closed heath on the limestone outcrops (Government of WA 2000). The Cottesloe – Central and South Complex has 35.2% remaining on the Swan Coastal Plain (WALGA 2013). This is above the 10% threshold recommended for Constrained Areas for assessing proposals affecting natural areas within the System 6 region (EPA 2006).

A total of 98 flora taxa were identified within the study area (73 native and 25 introduced taxa). The number of native flora species recorded was comparable to the number of species recorded from similar, nearby bushland areas (e.g. Romeo Road, approximately 2 km east where 91 flora taxa were identified comprising 64 native and 27 introduced taxa; ELA 2016). Although the Romeo Road survey area did have some comparable patches of good quality vegetation, it was a linear area and subject to greater threats and edge effects, whilst the current study area is more resilient to threatening processes due to its shape and size. Overall flora species diversity (native and introduced taxa) within the quadrats (40.2 species/quadrat) was much higher than nearby studies (33 species/quadrat; ELA 2016) suggesting that the study area has a high level of species diversity. In addition, mean weed species diversity (11.3 weed species/quadrat) was lower when compared to similar studies.

The vegetation within the study area was predominantly in Excellent and Very Good condition. Edge effects were clearly evident, with lower quality vegetation and species diversity closer to the road or tracks. A total of 14.1% of the study area was previously cleared or cleared for tracks or paths. The study area contained a range of disturbances, which was reflected in the condition of the vegetation. The largest source of disturbance was weeds, particularly edge effects from the road and adjacent clearings/developed areas and tracks. This has resulted in reduced native species diversity in these areas. Grass tree removal, rubbish dumping and feral animal diggings were also evident throughout the study area.

Two vegetation communities were recorded in the study area: BaBmLW and BsXpHtTOS. Vegetation community BaBmLW was found to correspond to Gibson et al (1994) FCT 28: Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands, with ELA quadrats joining three Gibson et al. (1994) FCT 28 quadrats at a 55% similarity. Vegetation community BsXpHtTOS was found to be most similar to FCT 24: Northern Spearwood shrublands and woodlands; (Gibson et al. 1994), with ELA quadrats joining four Gibson et al. (1994) FCT 24 quadrats at 33% and 35% similarity.

FCT 28 “Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands” has recently been listed as a TEC under the Commonwealth EPBC Act but is not currently listed under State legislation. FCT 24 “Northern Spearwood shrublands and woodlands” is currently listed as a Priority 3 PEC under State legislation.

The vegetation community BaBmLW represents the Banksia Woodland of the Swan Coastal Plain TEC which is listed as Endangered under the EPBC Act. In order for a patch of Banksia woodland to meet the TEC criteria and be listed under the EPBC Act, it must be classed within (at least) the Good Condition Category in accordance with the approved conservation advice (DotEE 2016c). The vegetation community BaBmLW within the study area was assessed as being in Excellent condition. This category states that the vegetation structure is intact with disturbances mainly affecting individual species, the presence of non-aggressive weed species and a high native plant species diversity (DotEE 2016c). In

addition, the vegetation community within the study area is considered to be a separate patch to nearby surrounding areas of the ecological community, and it may enable the movement of fauna and/or plant materials and therefore contributes to the overall function of the ecological community across the landscape.

Overall, due to the high level of species diversity within the vegetation communities (44.6 species/quadrat) and the occurrence of an Endangered TEC and Priority 3 PEC, the study area is likely to be considered an important area of remnant vegetation.

As vegetation community BaBmLW is considered to represent the Banksia Woodlands of the Swan Coastal Plain TEC, it is protected under the EPBC Act as a Matter of National Environmental Significance (MNES). In order to obtain environmental approval, any actions must undergo an environmental assessment and approval process to determine if the action is likely to have a 'significant' impact on the listed threatened ecological community.

## 5.2 Fauna

A total of 17 vertebrate fauna species were recorded opportunistically within the study area during the survey. Some of these species may occur within the study area on a regular basis, such as reptiles, whilst other species may only occur occasionally on a foraging or transitional basis (e.g. Rainbow Bee-eater).

The species recorded represent a snapshot of the fauna occurring within the study area, and it is therefore likely that many more species occur than were observed during the Level 1 survey. A total of 158 vertebrate fauna species (native and introduced) were identified as possibly occurring based on the NatureMap database search, including three amphibians, 32 reptiles, 108 birds and 15 mammals.

No amphibians were recorded during the survey. However, three species have been recorded from within 5 km of the study area in nearby bushland areas including *Limnodynastes dorsalis* (Western Banjo Frog), *Heleioporus eyrei* (Moaning Frog) and *Pseudophryne guentheri* (Crawling Toadlet). Both the Western Banjo Frog and Moaning Frog are adept at burrowing and are somewhat dependent on *Banksia* woodlands for a significant portion of their lifecycle, as non-breeding aestivating habitat, and therefore these species could possibly occur within the study area (DotEE 2016c).

Only one reptile species was recorded during the survey. The Swan Coastal Plain is exceptional in its reptile species richness (DotEE 2016c) and therefore there are likely to be more reptile species that occur within the study area, such as geckos, skinks and lizards. A total of 32 reptiles were identified as possibly occurring from the database searches. Suitable habitat for both fossorial and terrestrial reptiles is present throughout the study area, both within the bushland and areas of dumped rubbish. Two conservation significant reptiles were identified from the desktop review as potentially occurring: South West Carpet Python and Black-striped Snake. Both species are known to occur in nearby Neerabup National Park and suitable habitat occurs within the study area.

The majority of bird species recorded during the survey were widespread and common species. Two bird species of conservation significance were recorded during the survey, either through direct observation (Rainbow Bee-eater) or from foraging evidence (Carnaby's Cockatoos). Birds are generally well adapted to urban and peri-urban environments, with many species able to persist in some of the most fragmented, degraded bushland reserves around Perth. Based on the database searches, it is likely that a number of other nectarivorous and insectivorous birds would utilise the study area for foraging and breeding, but were not observed during the survey.



One native mammal was recorded within the study area: Western Grey Kangaroo. Although only one individual was observed, a large number of scats were observed throughout the study area suggesting that several individuals are likely to be present. Given the partially fragmented nature of the study area, it is possible that some of these individuals are resident, however it is also possible that they move between the study area and remnant tracts of bushland in Alkimos to the north and west. No other native mammals, such as Quenda (*Isodon obesulus fusciventer*), were observed, nor were any signs of diggings recorded that would indicate their presence within the study area. Endemic mammals such as the Honey Possum (*Tarsipes rostratus*) may occur given the presence of good quality Banksia woodlands and the proximity of the study area to the edge of the metropolitan area.

Several introduced species were recorded within the study area including the Laughing Turtle Dove, Rabbit and Red Fox. The Rabbit and Red Fox in particular, are likely to impact upon native flora and fauna, either through grazing, predation or competition.

In summary, the study area is likely to provide habitat and connectivity for many bird species and may be important for the continued presence of a range of local reptile and several mammal species. The occurrence of the Rainbow Bee-eater, Carnaby's Cockatoo and two species of raptor, highlight the foraging and potential breeding value of the study area, for avifauna in particular.

### 5.2.1 Black Cockatoos

The fauna habitat identified within the study area provides suitable foraging habitat for Carnaby's Cockatoo in the form of mixed *Banksia* woodlands and shrubland. Foraging species within the study area include proteaceous species such as *Banksias* and *Hakeas*. The foraging habitat within the study area is considered high value for Carnaby's Cockatoo, given the vegetation is largely intact and in Excellent to Very Good condition throughout. The study area is also within close proximity to high quality foraging habitat throughout Neerabup National Park and surrounds (1.2 km east).

Whilst there is no breeding or roosting habitat for Black Cockatoos within the study area, breeding is known to occur approximately 10 km north of the study area, within the Yanchep National Park (Department of Planning 2011). While breeding, Carnaby's Cockatoo will generally forage up to 12 km away from their nesting site (SEWPaC 2012), therefore the foraging habitat within the study area is likely to be considered an important food source for the species in a fragmented landscape. Additionally, there are numerous roosting sites within several kilometres of the study area (Department of Planning 2011). Local confirmed roost sites include those in Carabooda, Neerabup and Nowergup (Peck et al. 2016).

## 5.3 Environmental approvals

### 5.3.1 EPBC Act referral

Proposed clearing actions that have, or are likely to have, a significant impact on MNES (Banksia Woodlands TEC and Black Cockatoos) must be referred to the Commonwealth under the EPBC Act.

The results of the Black Cockatoo habitat assessment have been considered in reference to the EPBC Act referral guidelines (SEWPaC 2012) which state that actions at high risk of having a significant impact on Black Cockatoos should be referred to the Commonwealth environment minister. The referral guidelines for assessing whether an action has a high risk of significant impact are as follows (SEWPaC 2012):

- Clearing of any known nesting tree
- Clearing or degradation of any part of a vegetation community known to contain breeding habitat
- Clearing of 1 ha of quality foraging habitat
- Clearing or degradation of a known night roosting site

- Creating a gap of greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).

The results of the Black Cockatoo habitat assessment in specific reference to the referral guidelines are:

- The study area contains more than 1 ha of quality foraging habitat based on foraging species, extent and density, therefore there is a high risk of significant impact on Black Cockatoo foraging habitat.

If the City propose to clear more than 1 ha of vegetation considered good quality Black Cockatoo foraging habitat then the proposed action would be considered to have a high risk of significant impact on Black Cockatoos as defined in the referral guidelines and should be referred to the Commonwealth environment minister for further assessment (SEWPaC 2012).

In addition, if the City proposed to clear any area of remnant vegetation that represents the Banksia Woodlands of the Swan Coastal Plain TEC, then the proposed action should be referred to the Commonwealth for further assessment (DotEE 2016c).

### **5.3.2 Native vegetation clearing permit application**

The clearing of native vegetation in WA is regulated under Part V of the WA EP Act. As the City is proposing to clear areas of remnant vegetation, and given the occurrence of the Banksia Woodlands TEC and the occurrence of Threatened fauna listed as Endangered or Vulnerable under the WC Act (Black Cockatoos), the City will be required to submit an application for a native vegetation clearing permit (NVCP) to the Department of Environment Regulation (DER).

### **5.3.3 Environmental approvals under the bilateral agreement**

The City is likely to be able to undergo an environmental approvals process under the bilateral agreement, therefore omitting the need to go through both the Commonwealth and State processes separately. Proposed clearing actions that have, or are likely to have, a significant impact on MNES (Banksia Woodlands TEC and Black Cockatoos) must initially still be referred to the Commonwealth under the EPBC Act, and so the City would still be required to submit an EPBC Act referral. Under the bilateral agreement, the DER would be able to assess the impacts of clearing on relevant MNES whilst assessing the NVCP application.

## **5.4 Recommendations to minimise impacts**

The following mitigation measures are recommended to minimise impacts to the ecological values of the study area in the event of clearing activities:

- Reconsider project design and avoid clearing vegetation in Excellent or Very Good condition
- Retain areas of Excellent or Very Good condition vegetation for conservation/passive recreation
- Where possible avoid clearing areas containing the Banksia Woodlands TEC
- Delineate all clearing boundaries in the field and restrict clearing to that which is necessary
- Rehabilitate cleared areas not proposed for development as soon as practical
- Reduce indirect impacts to surrounding vegetation and fauna habitats by:
  - Implementing dust suppression measures, including management of road speeds on unsealed roads during construction
  - Implementing good hygiene practices to minimise the introduction or spread of weeds and pathogens (e.g. dieback)
  - Undertake feral animal control

- Investigate the removal of grasstrees as this could represent illegal vegetation clearing activity.

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# Appendix A Framework for conservation significant flora and fauna ranking

## Categories of threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
Extinct (EX)	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa has not been recorded in its known and/or expected habitat at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	Taxa considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Taxa considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Taxa considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
Not Evaluated (NE)	Taxa has not yet been evaluated against the criteria.
Migratory (M)	<p>Not an IUCN category.</p> <p>Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including:</p> <ul style="list-style-type: none"> <li>• the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state;</li> <li>• the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA);</li> <li>• the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or</li> <li>• the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to</li> </ul>

Category	Definition
	migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).

**Schedules under the State *Wildlife Conservation Act 1950* (WC Act)**

Schedule	Code	Conservation status	Description
<b>Schedule 1</b>  Fauna and flora that are extant and considered likely to become extinct or rare as critically endangered species and therefore are in need of special protection.	S1 (CR)	Threatened Flora	Declared Rare Flora that is rare or likely to become extinct – Critically Endangered
		Threatened Fauna	Fauna that is rare or likely to become extinct – Critically Endangered
<b>Schedule 2</b>  Fauna and flora that are extant and considered likely to become extinct or rare as endangered species and therefore in need of special protection.	S2 (EN)	Threatened Flora	Declared Rare Flora that is rare or likely to become extinct – Endangered
		Threatened Fauna	Fauna that is rare or likely to become extinct – Endangered
<b>Schedule 3</b>  Fauna and flora that are extant and considered likely to become extinct or rare as vulnerable species and therefore in need of special protection.	S3 (VU)	Threatened Flora	Declared Rare Flora that is rare or likely to become extinct – Vulnerable
		Threatened Fauna	Fauna that is rare or likely to become extinct – Vulnerable
<b>Schedule 4</b>  Fauna and flora that is presumed to be extinct in the wild and therefore in need of special protection.	S4 (EX)	Presumed Extinct Fauna	
<b>Schedule 5</b>  Birds that are subject to international agreements relating to the protection of migratory birds, are declared to be that is in need of special protection.	S5 (IA)	Migratory	Birds protected under an international agreement
<b>Schedule 6</b>  Fauna that are of special conservation need being species dependent on ongoing	S6 (CD)	Conservation dependent	Ongoing conservation intervention required

Schedule	Code	Conservation status	Description
conservation intervention, are declared to be fauna that is in need of special protection.			
<b>Schedule 7</b>			
Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.	S7 (OS)	Other specially protected	Other specially protected fauna

**Priority flora and fauna categories used by the Department of Parks and Wildlife.**

Category	Code	Definition
Priority 1	P1	<i>Poorly-known taxa.</i> Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
Priority 2	P2	<i>Poorly-known taxa.</i> Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
Priority 3	P3	<i>Poorly-known taxa.</i> Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority 4	P4	<i>Rare, Near Threatened and other taxa in need of monitoring.</i> (a) Rare. Taxa 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 taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority 5	P5	<i>Conservation dependent taxa.</i> Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

## Appendix B Likelihood of occurrence criteria for conservation significant flora and fauna

- Likelihood: No
  - Species not known to occur within the IBRA bioregion
  - Study area lacks important habitat for a species that has highly selective habitat requirements
  - Species has been historically recorded within study area or locally, however it is considered locally extinct due to significant habitat changes such as land clearing
- Likelihood: Unlikely
  - Species has been recorded locally through DPaW database search, however, is unlikely to occur due to lack of critical habitat and/or the site being severely degraded
    - Species has been recorded locally through DPaW database search, however, is unlikely to occur due to few historic record/s, no other current collections in the local area, and extensive on site searching has not detected species.
- Likelihood: Potential
  - Species has been recorded regionally, but has not been previously recorded in the study area; however, targeted surveys may locate the species based on records occurring in proximity to the study area and suitable habitat potentially occurring in the study area
  - Extensive survey efforts have not detected the species, however species is known to be cryptic and no effective standardised procedure is available, therefore occurrence should not be ruled out without further investigation
    - Species has been recorded in the study area by a previous consultant survey, however, doubt remains over taxonomic identification
    - Historical evidence of species occurrence within or outside of study area with coordinates doubtful
    - Historical evidence of species occurrence within project area, and while not considered as locally extinct, occasionally recorded locally based on available data
- Likelihood: Likely
  - Critical or core habitat in excellent condition and landform for the species occurs within the study area
  - Species has been recorded in proximity (<5 km) and in similar habitat to that which occurs within the area
- Likelihood: Yes
  - Species recorded during the survey, or previously recorded within study area from DPaW database search results and the species has been confirmed through a current vouchered specimen at WA Herbarium
  - Recent evidence of species positively identified within project area such as fresh scats, foot prints or burrows, or foraging residues.

## Appendix C DPaW database search results

Taxon	Status	Rank	IUCN Criteria	EPBC	Distribution	Flowering Period	Recovery Plan
<i>Amanita carneiphylla</i>	3				Murdoch, Dryandra, Mundijong, Yanchep, Caversham, Denmark	Fruiting Period: April to October	
<i>Amanita wadulawitu</i>	2				Winthrop, Yanchep N.P.		
<i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)	1				Wanneroo, North Beach, Scarborough, Yanchep, Marmion		
<i>Conostylis bracteata</i>	3				Mullaloo, Breton Bay, Guilderton, Yanchep	Jul, Aug	
<i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i>	4				Yanchep, Lancelin, Seabird, Wilbinga	Jul	
<i>Cyathochaeta teretifolia</i>	3				Whiteman Park, Lake Gnangara, Ellenbrook, Muchea, Denbarker, Yelverton, Wellard, Mundijong	Dec	
<i>Dasymalla axillaris</i>	T	CR	C1+C2a(j)b	CR	Pithara, Morawa, Lake Moore, Gnangara, Wongan Hills, Maya, Caron, Buntine, Latham, Perenjori	Jul-Oct	IRP
<i>Eucalyptus argutifolia</i>	T	VU	D1	VU	Yanchep, Lancelin, Seabird, Jurien, Yalgorup	Mar-Apr	
<i>Grevillea elongata</i>	T	EN	C2a	VU	Ruabon, Abba SF, Whicher Range, Butler SF	Oct	IRP
<i>Grevillea evanescens</i>	1				Yanchep, Gingin to Lancelin		
<i>Haloragis</i> sp. Parrot Ridge (G.J. Keighery 11563)	1				Yanchep		
<i>Jacksonia sericea</i>	4				Wanneroo, Trigg, Perth, Karrinyup, Mandurah-Pinjarra, Neerabup NPK, Ardross, Stakehill, Singleton	Oct-Jan	
<i>Lasiopetalum membranaceum</i>	3				Yalgorup, Capel, Dwellingup, Yandup, Australind, Dawesville, Yanchep	Oct-Nov	
<i>Lecania sylvestris</i>	2				Yanchep N.P.		
<i>Lecania turicensis</i> var. <i>turicensis</i>	2				Yanchep N.P., Burns Beach, Eastern States		
<i>Lepidium pseudotasmanicum</i>	4				Yanchep, Wongan Hills, Denmark, Albany, Porongurup R, Jerramungup, Munglinup, Stirling Range, Lake Clifton		
<i>Leucopogon maritimus</i>	1				Burns Beach, Yanchep, Two Rocks	Apr	
<i>Leucopogon</i> sp. Yanchep (M. Hislop 1986)	3				Yanchep N.P., Gnangarra-Moore River S.F., Neerabup N.P.	Apr-Jun, Sep	
<i>Pimelea calcicola</i>	3				Yanchep N.P., Burns Beach, Yalgorup N.P., Rockingham, Henderson, Beaconsfield	Sep-Nov	
<i>Placynthium nigrum</i>	3				Yanchep N.P., Mt Percy, York, Quinninup, Eastern States		
<i>Rinodina bischoffii</i>	2				Yanchep N.P.		
<i>Sarcozona bicarinata</i>	3				Hepburn Heights, Burns Beach, Wanneroo, Yanchep, Seabird, Espereance, Guilderton, S. Aust,		
<i>Sphaerolobium calcicola</i>	3				Yalgorup, Yanchep, Safety Bay, Myalup, Denmark	Jun/Sep-Nov	



FAMILY	NAME	COMMON_NAM	SOURCE_COD	CONSV_CODE	CLASS
Ardeidae	Ardea modesta	great egret, white egret	BIRDATLAS1	IA	BIRD
Potoroidae	Bettongia lesueur graii	boodie (inland), burrowing bettong	TFAUNA	EX	MAMMAL
Potoroidae	Bettongia penicillata ogilbyi	woylie, brush-tailed bettong	TFAUNA	CR	MAMMAL
Scolopacidae	Calidris acuminata	sharp-tailed sandpiper	BIRDATLAS1	IA	BIRD
Scolopacidae	Calidris subminuta	long-toed stint	BIRDATLAS1	IA	BIRD
Psittacidae	Calyptorhynchus baudinii	Baudin's cockatoo	BIRDATLAS1	EN	BIRD
Psittacidae	Calyptorhynchus latirostris	Carnaby's cockatoo	BIRDATLAS2	EN	BIRD
Cheloniidae	Caretta caretta	loggerhead turtle	WAM_REPTILES	EN	REPTILE
Cheloniidae	Chelonia mydas	green turtle	TFAUNA	VU	REPTILE
Dasyuridae	Dasyurus geoffroii	chuditch, western quoll	TFAUNA	VU	MAMMAL
Dermochelyidae	Dermochelys coriacea	leatherback turtle	TFAUNA	VU	REPTILE
Balaenidae	Eubalaena australis	southern right whale	WAM_MAMMALS	VU	MAMMAL
Peramelidae	Isoodon obesulus fusciventer	quenda, southern brown bandicoot	FAUNASURVEY	P4	MAMMAL
Macropodidae	Macropus irma	Western Brush Wallaby	TFAUNA	P4	MAMMAL
Meropidae	Merops ornatus	rainbow bee-eater	BIRDATLAS1	IA	BIRD
Elapidae	Neelaps calonotos	black-striped snake	FAUNASURVEY	P3	REPTILE
Anatidae	Oxyura australis	blue-billed duck	BIRDATLAS2	P4	BIRD
Accipitridae	Pandion haliaetus	osprey	TFAUNA	IA	BIRD
Macropodidae	Petrogale lateralis lateralis	black-flanked rock-wallaby, warru	TFAUNA	EN	MAMMAL
Castniidae	Synemon gratiosa	graceful sunmoth	FAUNASURVEY	P4	INVERTEBRATE

COM_ID	COM_NAME	CT_DESC
SCP19b	Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994)	Critically Endangered
Limestone ridges (SCP 26a)	Melaleuca huegelii - Melaleuca acerosa (currently M. systema) shrublands on limestone ridges (Gibson et al. 1994 type 26a	Endangered
CAVES SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	Critically Endangered
SCP24	Northern Spearwood shrublands and woodlands	Priority 3

# Appendix D NatureMap database search results

# NatureMap Species Report

Created By Guest user on 18/01/2017

Current Names Only Yes  
Core Datasets Only Yes  
Method 'By Circle'  
Centre 115° 41' 37" E, 31° 37' 47" S  
Buffer 5km  
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	374	1092
Other specially protected fauna	1	1
Priority 1	2	2
Priority 3	4	12
Priority 4	5	370
Priority 5	2	37
Protected under international agreement	3	7
Rare or likely to become extinct	5	80
<b>TOTAL</b>	<b>396</b>	<b>1601</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Rare or likely to become extinct</b>				
1.	1213 <i>Calectasia cyanea</i> (Blue Tinsel Lily)		T	
2.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)		T	
3.	25336 <i>Chelonia mydas</i> (Green Turtle)		T	
4.	25346 <i>Dermochelys coriacea</i> (Leatherback Turtle)		T	
5.	24043 <i>Eubalaena australis</i> (Southern Right Whale)		T	
<b>Protected under international agreement</b>				
6.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
7.	24716 <i>Puffinus pacificus</i> (Wedge-tailed Shearwater)		IA	
8.	24808 <i>Tringa nebularia</i> (Common Greenshank)		IA	
<b>Other specially protected fauna</b>				
9.	25240 <i>Morelia spilota subsp. imbricata</i> (Carpet Python)		S	
<b>Priority 1</b>				
10.	34161 <i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)		P1	
11.	33022 <i>Melaleuca</i> sp. Wanneroo (G.J. Keighery 16705)		P1	
<b>Priority 3</b>				
12.	11461 <i>Hibbertia spicata</i> subsp. <i>leptotheca</i>		P3	
13.	19460 <i>Leucopogon</i> sp. Yanchep (M. Hislop 1986)		P3	
14.	5237 <i>Pimelea calcicola</i>		P3	
15.	13127 <i>Stylidium maritimum</i>		P3	
<b>Priority 4</b>				
16.	11388 <i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i>		P4	
17.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
18.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
19.	24073 <i>Physeter macrocephalus</i> (Sperm Whale)		P4	
20.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
<b>Priority 5</b>				
21.	25478 <i>Isodon obesulus</i> (Southern Brown Bandicoot)		P5	
22.	24153 <i>Isodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P5	
<b>Non-conservation taxon</b>				
23.	15470 <i>Acacia barbinervis</i> subsp. <i>borealis</i>			
24.	3409 <i>Acacia lasiocarpa</i> (Panjang)			
25.	11611 <i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>			
26.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
27.	15482 <i>Acacia pulchella</i> var. <i>goadbyi</i>			
28.	3525 <i>Acacia rostellifera</i> (Summer-scented Wattle)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
29.	3584 <i>Acacia truncata</i>			
30.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
31.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
32.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
33.	1208 <i>Acanthocarpus preissii</i>			
34.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
35.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
36.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
37.	<i>Aganippe raphiduca</i>			
38.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
39.	1728 <i>Allocasuarina fraseriana</i> (Sheoak, Kondil)			
40.	1732 <i>Allocasuarina humilis</i> (Dwarf Sheoak)			
41.	<i>Amblyomma triguttatum</i>			
42.	<i>Aname mainae</i>			
43.	24312 <i>Anas gracilis</i> (Grey Teal)			
44.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
45.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
46.	6314 <i>Andersonia lehmanniana</i>			
47.	25553 <i>Anhinga melanogaster</i> (Darter)			
48.	<i>Anhinga novaehollandiae</i>			
49.	1409 <i>Anigozanthos humilis</i> (Catspaw)			
50.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
51.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
52.	<i>Antichiropus whistleri</i>			
53.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
54.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
55.	<i>Araneus cyphoxis</i>			
56.	<i>Araneus senicaudatus</i>			
57.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
58.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
59.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
60.	6331 <i>Astroloma microcalyx</i> (Native Cranberry)			
61.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
62.	17240 <i>Austrostipa flavescens</i>			
63.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
64.	24318 <i>Aythya australis</i> (Hardhead)			
65.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
66.	<i>Barnardius zonarius</i>			
67.	38765 <i>Battarrea stevenii</i>			
68.	743 <i>Baumea juncea</i> (Bare Twigrush)			
69.	26503 <i>Betaphycus speciosum</i>			
70.	24319 <i>Biziura lobata</i> (Musk Duck)			
71.	24251 <i>Bos taurus</i> (European Cattle)	Y		
72.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
73.	42381 <i>Brachyuropsis semifasciatus</i> (Southern Shovel-nosed Snake)			
74.	3000 <i>Brassica tournefortii</i> (Mediterranean Turnip)	Y		
75.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
76.	245 <i>Briza minor</i> (Shivery Grass)	Y		
77.	249 <i>Bromus diandrus</i> (Great Brome)	Y		
78.	27602 <i>Buellia georgei</i>			
79.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
80.	25715 <i>Cacatua roseicapilla</i> (Galah)			
81.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
82.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
83.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
84.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
85.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
86.	15352 <i>Caladenia georgei</i>			
87.	1599 <i>Caladenia latifolia</i> (Pink Fairy Orchid)			
88.	15361 <i>Caladenia longicauda</i> subsp. <i>calcigena</i>			
89.	2856 <i>Calandrinia liniflora</i> (Parakeelya)			
90.	5426 <i>Calothamnus quadrifidus</i> (One-sided Bottlebrush, Kwojdjard)			
91.	5429 <i>Calothamnus sanguineus</i> (Silky-leaved Blood flower, Pindak)			
92.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
93.	24254 <i>Camelus dromedarius</i> (Dromedary, Camel)	Y		
94.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
95.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
96.	26562 <i>Caulerpa fergusonii</i>			
97.	46993 <i>Caulerpa taxifolia</i> var. <i>distichophylla</i>			
98.	1125 <i>Centrolepis drummondiana</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
99.	2889 <i>Cerastium glomeratum</i> (Mouse Ear Chickweed)	Y		
100.	24373 <i>Charadrius melanops</i> (Black-fronted Dotterel)			
101.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
102.	43380 <i>Chelodina colliei</i> (Oblong Turtle)			
103.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
104.	2483 <i>Chenopodium album</i> (Fat Hen)	Y		
105.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
106.	<i>Chroicocephalus novaehollandiae</i>			
107.	24288 <i>Circus approximans</i> (Swamp Harrier)			
108.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
109.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
110.	4552 <i>Comesperma confertum</i>			
111.	15611 <i>Conospermum stoechadis</i> subsp. <i>stoechadis</i> (Common Smokebush)			
112.	1885 <i>Conospermum triplinervium</i> (Tree Smokebush)			
113.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
114.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
115.	1427 <i>Conostylis candicans</i> (Grey Cottonhead)			
116.	1454 <i>Conostylis setigera</i> (Bristly Cottonhead)			
117.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
118.	<i>Cormocephalus turneri</i>			
119.	24416 <i>Corvus bennetti</i> (Little Crow)			
120.	25592 <i>Corvus coronoides</i> (Australian Raven)			
121.	1285 <i>Corynotheca micrantha</i> (Sand Lily)			
122.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
123.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
124.	42009 <i>Craspedia</i> sp. Yalgrop National Park (G.J. Keighery 14449)			
125.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
126.	24918 <i>Crenadactylus ocellatus</i> subsp. <i>ocellatus</i> (Clawless Gecko)			
127.	4802 <i>Cryptandra mutila</i>			
128.	30893 <i>Cryptoblepharus buchananii</i>			
129.	26709 <i>Cryptonemia undulata</i>			
130.	25027 <i>Ctenotus australis</i>			
131.	25039 <i>Ctenotus fallens</i>			
132.	25825 <i>Cucurbita pepo</i>	Y		
133.	24322 <i>Cygnus atratus</i> (Black Swan)			
134.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
135.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
136.	3807 <i>Daviesia divaricata</i> (Marno)			
137.	18560 <i>Daviesia divaricata</i> subsp. <i>divaricata</i>			
138.	30906 <i>Delma concinna</i> (Javelin Legless Lizard)			
139.	30905 <i>Delma concinna</i> subsp. <i>concinna</i> (Javelin Legless Lizard)			
140.	17663 <i>Desmocladius asper</i>			
141.	1259 <i>Dianella revoluta</i> (Blueberry Lily)			
142.	11636 <i>Dianella revoluta</i> var. <i>divaricata</i>			
143.	1287 <i>Dichopogon capillipes</i>			
144.	26763 <i>Dictyomenia tridens</i>			
145.	26767 <i>Dictyopteris plagiogramma</i>			
146.	26778 <i>Dictyota furcellata</i>			
147.	24939 <i>Diplodactylus polyophthalmus</i>			
148.	19649 <i>Disa bracteata</i>	Y		
149.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			
150.	3106 <i>Drosera macrantha</i> (Bridal Rainbow)			
151.	13216 <i>Drosera menziesii</i> subsp. <i>penicillaris</i>			
152.	25100 <i>Egernia napoleonis</i>			
153.	<i>Egretta novaehollandiae</i>			
154.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
155.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
156.	<i>Elanus axillaris</i>			
157.	1643 <i>Elythranthera brunonis</i> (Purple Enamel Orchid)			
158.	<i>Eolophus roseicapillus</i>			
159.	6132 <i>Epilobium ciliatum</i>	Y		
160.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
161.	376 <i>Eragrostis curvula</i> (African Lovegrass)	Y		
162.	1646 <i>Eriochilus dilatatus</i> (White Bunny Orchid)			
163.	4332 <i>Erodium botrys</i> (Long Storksbill)	Y		
164.	15446 <i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>			
165.	5615 <i>Eucalyptus decipiens</i> (Limestone Marlock, Moit)			
166.	5649 <i>Eucalyptus foecunda</i> (Narrow-leaved Red Mallee)			
167.	5659 <i>Eucalyptus gomphocephala</i> (Tuart, Duart)			
168.	13541 <i>Eucalyptus petrensis</i>			

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169.	13511	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>			
170.	25621	<i>Falco berigora</i> (Brown Falcon)			
171.	25622	<i>Falco cenchroides</i> (Australian Kestrel)			
172.	25623	<i>Falco longipennis</i> (Australian Hobby)			
173.	24041	<i>Felis catus</i> (Cat)	Y		
174.	25727	<i>Fulica atra</i> (Eurasian Coot)			
175.	24761	<i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
176.	7976	<i>Galinsoga parviflora</i> (Potato Weed)	Y		
177.	25729	<i>Gallinula tenebrosa</i> (Dusky Moorhen)			
178.	24763	<i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
179.	25530	<i>Gerygone fusca</i> (Western Gerygone)			
180.	1520	<i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
181.	33620	<i>Glischrocaryon angustifolium</i>			
182.	6143	<i>Glischrocaryon aureum</i> (Common Popflower)			
183.	24735	<i>Glossopsitta porphyrocephala</i> (Purple-crowned Lorikeet)			
184.	3957	<i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
185.	6161	<i>Gonocarpus pithyoides</i>			
186.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
187.	2119	<i>Grevillea vestita</i>			
188.	12824	<i>Grevillea vestita</i> subsp. <i>vestita</i>			
189.	2784	<i>Gyrostemon ramulosus</i> (Corkybark)			
190.	1468	<i>Haemodorum laxum</i>			
191.	2146	<i>Hakea costata</i> (Ribbed Hakea)			
192.	2175	<i>Hakea lissocarpha</i> (Honey Bush)			
193.	2203	<i>Hakea ruscifolia</i> (Candle Hakea)			
194.	2214	<i>Hakea trifurcata</i> (Two-leaf Hakea)			
195.	24295	<i>Haliastur sphenurus</i> (Whistling Kite)			
196.	24689	<i>Halobaena caerulea</i> (Blue Petrel)			
197.	3961	<i>Hardenbergia comptoniana</i> (Native Wisteria)			
198.	25410	<i>Heleioporus eyrei</i> (Moaning Frog)			
199.	3016	<i>Heliophila pusilla</i>	Y		
200.	16933	<i>Hemiandra glabra</i>			
201.	25119	<i>Hemiergis quadrilineata</i>			
202.	26915	<i>Hennedya crispa</i>			
203.	5112	<i>Hibbertia aurea</i>			
204.	5135	<i>Hibbertia hypericoides</i> (Yellow Buttercups)			
205.	45534	<i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
206.	43280	<i>Hibbertia sericosepala</i>			
207.	25734	<i>Himantopus himantopus</i> (Black-winged Stilt)			
208.	24491	<i>Hirundo neoxena</i> (Welcome Swallow)			
209.	445	<i>Holcus setiger</i> (Annual Fog)	Y		
210.	6222	<i>Homalosciadium homalocarpum</i>			
211.	12859	<i>Hovea trisperma</i> var. <i>trisperma</i>			
212.	5216	<i>Hybanthus calycinus</i> (Wild Violet)			
213.	6232	<i>Hydrocotyle hispidula</i>			
214.	35898	<i>Hypnea musciformis</i>			
215.	8086	<i>Hypochoeris glabra</i> (Smooth Catsear)	Y		
216.		<i>Indolpium</i> sp.			
217.	4029	<i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
218.	26995	<i>Kuetzingia canaliculata</i>			
219.	16091	<i>Lachenalia bulbifera</i>	Y		
220.	467	<i>Lagurus ovatus</i> (Hare's Tail Grass)	Y		
221.	24367	<i>Lalage tricolor</i> (White-winged Triller)			
222.	28342	<i>Landoltia punctata</i> (Thin Duckweed)			
223.	24511	<i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
224.	26998	<i>Laurencia brongniartii</i>			
225.	27001	<i>Laurencia filiformis</i>			
226.	7580	<i>Lechenaultia linarioides</i> (Yellow Leschenaultia)			
227.	925	<i>Lepidosperma angustatum</i>			
228.	42742	<i>Lepidosperma calcicola</i>			
229.	944	<i>Lepidosperma scabrum</i>			
230.	945	<i>Lepidosperma squamatum</i>			
231.	1653	<i>Leporella fimbriata</i> (Hare Orchid)			
232.	17852	<i>Leptorhynchus scaber</i> (Lanky Buttons)			
233.	25133	<i>Lerista elegans</i>			
234.	25165	<i>Lerista praepedita</i>			
235.	6427	<i>Leucopogon parviflorus</i> (Coast Beard-heath)			
236.	6434	<i>Leucopogon polymorphus</i>			
237.	7677	<i>Levenhookia stipitata</i> (Common Stylewort)			
238.	25005	<i>Lialis burtonis</i>			



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239.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
240.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
241.	7408 <i>Lobelia tenuior</i> (Slender Lobelia)			
242.	27044 <i>Lobospira bicuspidata</i>			
243.	1228 <i>Lomandra hermaphrodita</i>			
244.	1231 <i>Lomandra maritima</i>			
245.	14542 <i>Lomandra micrantha</i> subsp. <i>micrantha</i>			
246.	1239 <i>Lomandra preissii</i>			
247.	1246 <i>Lomandra suaveolens</i>			
248.	4066 <i>Lupinus cosentinii</i>	Y		
249.	6456 <i>Lysinema ciliatum</i> (Curry Flower)			
250.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
251.	85 <i>Macrozamia riedlei</i> ( <i>Zamia</i> , <i>Djiridji</i> )			
252.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
253.	24544 <i>Malurus lamberti</i> subsp. <i>assimilis</i> (Variegated Fairy-wren)			
254.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
255.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
256.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
257.	<i>Masasteron sampeyae</i>			
258.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
259.	5920 <i>Melaleuca huegelii</i> (Chenille Honeymyrtle)			
260.	18598 <i>Melaleuca systema</i>			
261.	25184 <i>Menetia greyii</i>			
262.	955 <i>Mesomelaena pseudostygia</i>			
263.	27068 <i>Metagoniolithon radiatum</i>			
264.	<i>Meuschenia freycineti</i>			
265.	<i>Microcarbo melanoleucos</i>			
266.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
267.	15419 <i>Microtis media</i> subsp. <i>media</i>			
268.	8106 <i>Millotia tenuifolia</i> (Soft Millotia)			
269.	25192 <i>Morethia obscura</i>			
270.	24223 <i>Mus musculus</i> (House Mouse)	Y		
271.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
272.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
273.	25748 <i>Ninox novaeseelandiae</i> (Boobook Owl)			
274.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
275.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
276.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
277.	<i>Occiperipatoides gilesii</i>			
278.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
279.	<i>Odax cyanomelas</i>			
280.	1537 <i>Orthrosanthus laxus</i> (Morning Iris)			
281.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
282.	27108 <i>Osmundaria spiralis</i>			
283.	34016 <i>Ovis aries</i> (Sheep)			
284.	4356 <i>Oxalis pes-caprae</i> (Soursob)	Y		
285.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
286.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
287.	<i>Paraplectanoides crassipes</i>			
288.	25253 <i>Parasuta gouldii</i>			
289.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
290.	4343 <i>Pelargonium capitatum</i> (Rose Pelargonium)	Y		
291.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
292.	20368 <i>Petrophile axillaris</i>			
293.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
294.	2301 <i>Petrophile macrostachya</i>			
295.	2309 <i>Petrophile serruriae</i>			
296.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
297.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
298.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
299.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
300.	16177 <i>Phyllangium paradoxum</i>			
301.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
302.	2793 <i>Phytolacca octandra</i> (Red Ink Plant)	Y		
303.	42281 <i>Pithocarpa cordata</i>			
304.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
305.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
306.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
307.	27155 <i>Plocamium cartilagineum</i>			
308.	573 <i>Poa drummondiana</i> (Knotted Poa)			

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309.	578 <i>Poa porphyroclados</i>			
310.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
311.	8183 <i>Pododthea chrysantha</i> (Yellow Pododthea)			
312.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
313.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
314.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
315.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
316.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
317.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
318.	24770 <i>Porzana pusilla</i> subsp. <i>palustris</i> (Baillon's Crake)			
319.	25511 <i>Pseudonaja affinis</i> (Dugite)			
320.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
321.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
322.	12217 <i>Pterostylis sanguinea</i>			
323.	18658 <i>Pterostylis</i> sp. <i>short sepals</i> (W. Jackson BJ259)			
324.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
325.	2751 <i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
326.	40841 <i>Ptilotus stirlingii</i> subsp. <i>stirlingii</i>			
327.	<i>Purpureicephalus spurius</i>			
328.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
329.	8195 <i>Quinetia urvillei</i>			
330.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
331.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
332.	<i>Raveniella cirrata</i>			
333.	<i>Raveniella peckorum</i>			
334.	11341 <i>Rhagodia baccata</i> subsp. <i>baccata</i>			
335.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
336.	15035 <i>Rhodanthe corymbosa</i>			
337.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
338.	27260 <i>Sargassum tristichum</i>			
339.	13182 <i>Scaevola repens</i> var. <i>repens</i>			
340.	982 <i>Schoenus clandestinus</i>			
341.	984 <i>Schoenus curvifolius</i>			
342.	985 <i>Schoenus discifer</i>			
343.	997 <i>Schoenus lanatus</i> (Woolly Bog-rush)			
344.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
345.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
346.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
347.	30948 <i>Smicromis brevirostris</i> (Weebill)			
348.	9259 <i>Solanum nodiflorum</i> (Glossy Nightshade)	Y		
349.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
350.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
351.	1558 <i>Sparaxis bulbifera</i>	Y		
352.	4828 <i>Spyridium globulosum</i> (Basket Bush)			
353.	3080 <i>Stenopetalum robustum</i>			
354.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
355.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
356.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
357.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
358.	20521 <i>Stylidium rigidulum</i>			
359.	1260 <i>Stypandra glauca</i> (Blind Grass)			
360.	15532 <i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>			
361.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
362.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
363.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
364.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
365.	4256 <i>Templetonia retusa</i> (Cockies Tongues)			
366.	27329 <i>Thamnophyllis lacerata</i>			
367.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
368.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
369.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
370.	1343 <i>Thysanotus patersonii</i>			
371.	1351 <i>Thysanotus sparteus</i>			
372.	25519 <i>Tiliqua rugosa</i>			
373.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
374.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
375.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
376.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
377.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
378.	4292	<i>Trifolium campestre</i> (Hop Clover)	Y		
379.	4295	<i>Trifolium dubium</i> (Suckling Clover)	Y		
380.	4297	<i>Trifolium glomeratum</i> (Cluster Clover)	Y		
381.	4309	<i>Trifolium scabrum</i> (Rough Clover)	Y		
382.	152	<i>Triglochin trichophora</i>			
383.	27347	<i>Tylotus obtusatus</i>			
384.		<i>Urodacus novaehollandiae</i>			
385.	8255	<i>Ursinia anthemoides</i> (Ursinia)	Y		
386.	25526	<i>Varanus tristis</i> (Racehorse Monitor)			
387.	15725	<i>Verbesina encelioides</i>	Y		
388.	7110	<i>Veronica distans</i>			
389.	11474	<i>Vicia sativa</i> subsp. <i>nigra</i>	Y		
390.	724	<i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
391.	7389	<i>Wahlenbergia preissii</i>			
392.	8282	<i>Waitzia suaveolens</i> (Fragrant Waitzia)			
393.		<i>Weistrarchaea spinosa</i>			
394.	1256	<i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
395.	6289	<i>Xanthosia huegelii</i>			
396.	25765	<i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

**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

<sup>1</sup> 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 E PMST database search 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: 18/01/17 16:22:13

[Summary](#)

[Details](#)

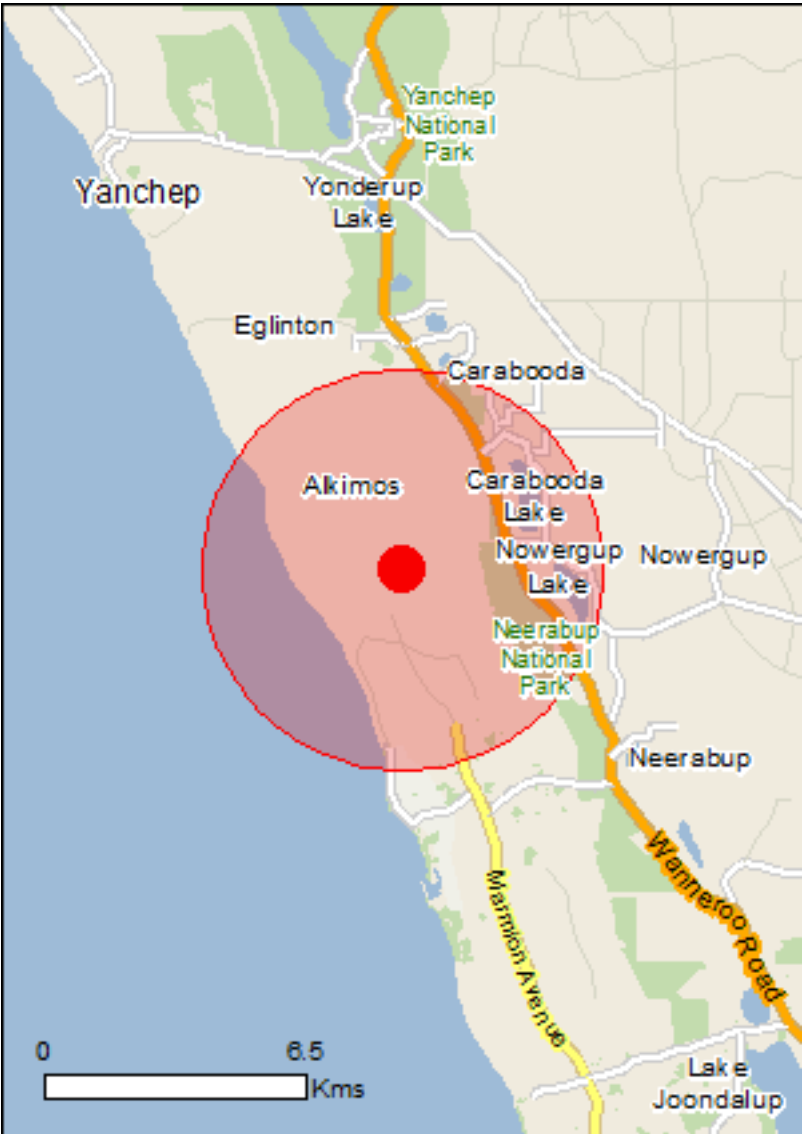
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

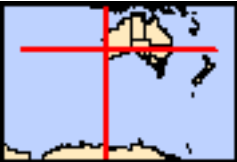
[Acknowledgements](#)



This map may contain data which are  
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[Coordinates](#)

[Buffer: 5.0Km](#)



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	2
<a href="#">Listed Threatened Species:</a>	44
<a href="#">Listed Migratory Species:</a>	40

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	68
<a href="#">Whales and Other Cetaceans:</a>	13
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	3
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	35
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Listed Threatened Ecological Communities

[ Resource Information ]

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

Name	Status	Type of Presence
<a href="#">Banksia Woodlands of the Swan Coastal Plain</a>	Endangered	Community may occur within area
<a href="#">Sedgelands in Holocene dune swales of the southern Swan Coastal Plain</a>	Endangered	Community known to occur within area

Listed Threatened Species

[ Resource Information ]

Name	Status	Type of Presence
Birds		
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora (sensu stricto)</a> Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans (sensu lato)</a> Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Halobaena caerulea</a> Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area



Name	Status	Type of Presence
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Limosa lapponica baueri</a> Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
<a href="#">Limosa lapponica menzbieri</a> Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pachyptila turtur subantarctica</a> Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<a href="#">Sternula nereis nereis</a> Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<a href="#">Thalassarche cauta cauta</a> Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche cauta steadi</a> White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Plants		
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
<a href="#">Lepidosperma rostratum</a> Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Reptiles		
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Sharks		
<a href="#">Carcharias taurus (west coast population)</a> Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[ Resource Information ]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora (sensu stricto)</a> Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans (sensu lato)</a> Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Puffinus carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
<a href="#">Sterna anaethetus</a> Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Sterna caspia</a> Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<a href="#">Thalassarche cauta (sensu stricto)</a> Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		

Name	Threatened	Type of Presence
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Lagenorhynchus obscurus</a> Dusky Dolphin [43]		Species or species habitat may occur within area
<a href="#">Lamna nasus</a> Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
<a href="#">Manta alfredi</a> Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
<a href="#">Manta birostris</a> Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area



Name	Threatened	Type of Presence
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	<a href="#">[ Resource Information ]</a>
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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 -

Listed Marine Species	<a href="#">[ Resource Information ]</a>
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\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Catharacta skua</a> Great Skua [59472]		Species or species habitat may occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora (sensu stricto)</a> Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
<a href="#">Diomedea exulans (sensu lato)</a> Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Halobaena caerulea</a> Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
<a href="#">Larus novaehollandiae</a> Silver Gull [810]		Breeding known to occur within area
<a href="#">Larus pacificus</a> Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat may occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pachyptila turtur</a> Fairy Prion [1066]		Species or species habitat likely to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
<a href="#">Puffinus assimilis</a> Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Puffinus carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Sterna anaethetus</a> Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Sterna caspia</a> Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<a href="#">Thalassarche cauta (sensu stricto)</a> Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
<a href="#">Acentronura australe</a> Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
<a href="#">Campichthys galei</a> Gale's Pipefish [66191]		Species or species habitat may occur within area
<a href="#">Choeroichthys suillus</a> Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
<a href="#">Halicampus brocki</a> Brock's Pipefish [66219]		Species or species habitat may occur within area
<a href="#">Hippocampus angustus</a> Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
<a href="#">Hippocampus breviceps</a> Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
<a href="#">Hippocampus subelongatus</a> West Australian Seahorse [66722]		Species or species habitat may occur within area



Name	Threatened	Type of Presence
<a href="#">Lissocampus fatiloquus</a> Prophet's Pipefish [66250]		Species or species habitat may occur within area
<a href="#">Maroubra perserrata</a> Sawtooth Pipefish [66252]		Species or species habitat may occur within area
<a href="#">Mitotichthys meraculus</a> Western Crested Pipefish [66259]		Species or species habitat may occur within area
<a href="#">Nannocampus subosseus</a> Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
<a href="#">Phycodurus eques</a> Leafy Seadragon [66267]		Species or species habitat may occur within area
<a href="#">Phyllopteryx taeniolatus</a> Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
<a href="#">Pugnaso curtirostris</a> Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
<a href="#">Solegnathus lettiensis</a> Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
<a href="#">Stigmatopora argus</a> Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
<a href="#">Stigmatopora nigra</a> Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
<a href="#">Stigmatopora olivacea</a> a pipefish [74966]		Species or species habitat may occur within area
<a href="#">Syngnathoides biaculeatus</a> Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
<a href="#">Urocampus carinirostris</a> Hairy Pipefish [66282]		Species or species habitat may occur within area
<a href="#">Vanacampus margaritifer</a> Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
<a href="#">Arctocephalus forsteri</a> Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Reptiles		
<a href="#">Aipysurus pooleorum</a> Shark Bay Seasnake [66061]		Species or species habitat may occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Disteira kingii</a> Spectacled Seasnake [1123]		Species or species habitat may occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Pelamis platurus</a> Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[ Resource Information ]
Name	Status	Type of Presence
Mammals		
<a href="#">Balaenoptera acutorostrata</a> Minke Whale [33]		Species or species habitat may occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Delphinus delphis</a> Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<a href="#">Lagenorhynchus obscurus</a> Dusky Dolphin [43]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[ <a href="#">Resource Information</a> ]
Name	State
Neerabup	WA
Neerabup	WA
Yanchep	WA

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within

Name	Status	Type of Presence
Pinus radiata		area
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus		
Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

# Caveat

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

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

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

-31.62972 115.69361



# Acknowledgements

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

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

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

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

# Appendix F Conservation significant flora likelihood of occurrence

Species	Conservation code <sup>1</sup>			Source*	Likelihood of occurrence	
	EPBC Act	WC Act	Parks and Wildlife		Pre-survey	Post survey
<i>Calectasia cyanea</i>	CR	T	CR	NatureMap	Potential	Unlikely
<i>Dasymalla axillaris</i>	CR	T	CR	TPFL	Unlikely	Unlikely
<i>Caladenia huegelii</i>	EN	T	CR	PMST	Unlikely	Unlikely
<i>Diuris purdiei</i>	EN	T	EN	PMST	Unlikely	Unlikely
<i>Drakaea elastica</i>	EN	T	CR	PMST	Unlikely	Unlikely
<i>Grevillea elongata</i>	VU	T	EN	TPFL	Unlikely	Unlikely
<i>Lepidosperma rostratum</i>	EN	T	EN	PMST	Unlikely	Unlikely
<i>Diuris micrantha</i>	VU	T	VU	PMST	Unlikely	Unlikely
<i>Drakaea micrantha</i>	VU	T	EN	PMST	Unlikely	Unlikely
<i>Eucalyptus argutifolia</i>	VU	T	VU	NatureMap PMST TPFL WAHerb	Potential	Unlikely
<i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)			P1	NatureMap TPFL WAHerb	Potential	Unlikely
<i>Grevillea evanescens</i>			P1	TPFL	Unlikely	Unlikely
<i>Haloragis</i> sp. Parrot Ridge (G.J. Keighery 11563)			P1	TPFL	Unlikely	Unlikely
<i>Leucopogon maritimus</i>			P1	TPFL	Potential	Unlikely
<i>Melaleuca</i> sp. Wanneroo (G.J. Keighery 16705)			P1	NatureMap	Potential	Unlikely
<i>Amanita wadulawitu</i>			P2	TPFL	Unlikely	Unlikely
<i>Lecania sylvestris</i>			P2	TPFL	Unlikely	Unlikely
<i>Lecania turicensis</i> var. <i>turicensis</i>			P2	TPFL	Unlikely	Unlikely
<i>Rinodina bischoffii</i>			P2	TPFL	Potential	Unlikely
<i>Amanita carneiphylla</i>			P3	TPFL	Unlikely	Unlikely
<i>Conostylis bracteata</i>			P3	TPFL	Potential	Unlikely
<i>Cyathochaeta teretifolia</i>			P3	TPFL	Unlikely	Unlikely
<i>Hibbertia spicata</i> subsp. <i>leptotheca</i>			P3	NatureMap TPFL WAHerb	Unlikely	Unlikely

Species	Conservation code <sup>1</sup>			Source*	Likelihood of occurrence	
	EPBC Act	WC Act	Parks and Wildlife		Pre-survey	Post survey
<i>Lasiopetalum membranaceum</i>			P3	TPFL	Unlikely	Unlikely
<i>Leucopogon</i> sp. Yanchep (M. Hislop 1986)			P3	NatureMap TPFL WAHerb	Potential	Unlikely
<i>Placynthium nigrum</i>			P3	TPFL	Unlikely	Unlikely
<i>Pimelea calcicola</i>			P3	NatureMap TPFL WAHerb	Potential	Unlikely
<i>Sarcozona bicarinata</i>			P3	TPFL	Potential	Unlikely
<i>Sphaerolobium calcicola</i>			P3	TPFL	Unlikely	Unlikely
<i>Stylidium maritimum</i>			P3	NatureMap TPFL WAHerb	Potential	Unlikely
<i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i>			P4	NatureMap	Potential	Unlikely
<i>Jacksonia sericea</i>			P4	TPFL	Potential	Unlikely
<i>Lepidium pseudotasmanicum</i>			P4	TPFL	Potential	Unlikely

<sup>1</sup> CR = listed as 'Critically Endangered' under the EPBC Act, EN = listed as 'Endangered' under the EPBC Act, V = Listed as 'Vulnerable' under the EPBC Act, T = Threatened Flora under the WC Act and P = Priority Flora listed by Parks and Wildlife

\* WAHERB = Western Australian Herbarium Database, TPFL = Threatened and Priority Flora Database (DPaW 2016c), PMST = EPBC Act Protected Matters Report (DoE 2016b); NatureMap = NatureMap database search (DPaW 2016c).

# Appendix G Conservation significant fauna likelihood of occurrence

Scientific name	Common name	Conservation code			Source	Likelihood of occurrence	
		EPBC Act	WC Act	Parks and Wildlife		Pre-survey	Post survey
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	CR	S1	CR	DPaW	Unlikely	No
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	S2		PMST	Unlikely	Unlikely
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	T	EN	DPaW	Unlikely	Unlikely
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	T	EN	DPaW, NatureMap, PMST	Likely	Yes
<i>Petrogale lateralis</i>	Black-flanked Rock-wallaby, warru	EN	S2	EN	DPaW	Unlikely	No
<i>Rostratula australis</i>	Australian Painted Snipe	EN			PMST	Unlikely	Unlikely
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	VU	S3	VU	PMST	Potential	Potential
<i>Calidris ferruginea</i>	Curlew Sandpiper	VU & IA	S3	VU	PMST	Unlikely	Unlikely
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	VU	S3	VU	PMST	Unlikely	Unlikely
<i>Apus pacificus</i>	Fork-tailed Swift	IA	S5		PMST	Potential	Potential
<i>Ardea modesta, Ardea alba</i>	Great Egret, White Egret	IA	S5		DPaW	Unlikely	Unlikely
<i>Calidris acuminata</i>	sharp-tailed sandpiper	IA	S5		DPaW	Unlikely	Unlikely
<i>Calidris subminuta</i>	Long-toed Stint	IA	S5		DPaW	Unlikely	Unlikely

Scientific name	Common name	Conservation code			Source	Likelihood of occurrence	
		EPBC Act	WC Act	Parks and Wildlife		Pre-survey	Post survey
<i>Tringa nebularia</i>	Common Greenshank	IA	S5		NatureMap	Unlikely	Unlikely
<i>Merops ornatus</i>	Rainbow Bee-eater <sup>1</sup>	M			NatureMap	Potential	Yes
<i>Motacilla cinerea</i>	Grey Wagtail	M	S5		PMST	Potential	Potential
<i>Pandion haliaetus</i>	Osprey	M	S5		PMST DPaW	Potential	Unlikely
<i>Morelia spilota subsp. imbricata</i>	Carpet Python		OS		Naturemap	Potential	Potential
<i>Neelaps calonotos</i>	Black-striped Snake			P3	DPaW	Potential	Potential
<i>Macropus irma</i>	Western Brush Wallaby			P4	NatureMap	Potential	Unlikely
<i>Oxyura australis</i>	Blue-billed Duck			P4	NatureMap DPaW	Unlikely	Unlikely
<i>Synemon gratiosa</i>	Graceful Sun-moth			P4	NatureMap DPaW	Potential	Potential
<i>Isodon obesulus fusciventer</i>	Quenda, southern brown bandicoot			P5	NatureMap DPaW	Potential	Unlikely

\*EN = listed as Endangered under the EPBC Act, WC Act and/or the IUCN red list.

VU = listed as Vulnerable under the EPBC Act, WC Act and/or the IUCN red list.

M = listed as Migratory species under the EPBC Act.

S2 = Schedule 2: Fauna that is rare or likely to become extinct as endangered fauna (EN)

S3 = Schedule 3: Fauna that is rare or likely to become extinct as vulnerable fauna (VU)

S5 = Schedule 5: Migratory birds protected under an international agreement (IA)

S7 = Schedule 7: Other specially protected fauna (OS).

IA = Migratory birds protected under an international agreement.

OS = Other Specially Protected fauna.

P3 = Priority 3: known from few specimens or records and need urgent survey and evaluation of conservation status.

P4 = Priority 4: not currently threatened but could if present circumstances change. Usually found on conservation lands.

P5 = not considered threatened but subject to a specific conservation program.

#Source: NatureMap (Parks and Wildlife 2015c), PMST (DoE 2015b).

1 the Rainbow Bee-eater is no longer listed as Migratory under the EPBC Act, but remains listed as Marine.

## Appendix H Quadrat data



Site number	Date	Site type	Observer
ELA_01	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376439	6499633
Condition	Disturbance	Fire (years)	Geology
Excellent	Weeds	Young (<5)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia menziesii</i>	15	U	Trees under 10 m
<i>Banksia attenuata</i>	2	U	Trees under 10 m
<i>Allocasuarina humilis</i>	0.1	M	Shrubs 1 - 2 m
<i>Hibbertia hypericoides</i>	30	M	Shrubs under 1 m
<i>Xanthorrhoea preissii</i>	0.5	M	Shrubs under 1 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.25	M	Shrubs under 1 m
<i>Leucopogon polymorphus</i>	0.25	M	Shrubs under 1 m
<i>Gompholobium tomentosum</i>	0.1	M	Shrubs under 1 m
* <i>Ehrharta calycina</i>	1	L	Grasses
<i>Austrostipa flavescens</i>	0.75	L	Grasses
<i>Amphipogon turbinatus</i>	0.1	L	Grasses
* <i>Avena barbata</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
* <i>Ehrharta longiflora</i>	0.1	L	Grasses
* <i>Pentameris airoides</i>	0.1	L	Grasses
* <i>Vulpia myuros</i>	0.1	L	Grasses
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.75	L	Herbs

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Podotheca gnaphalioides</i>	0.25	L	Herbs
<i>Burchardia congesta</i>	0.1	L	Herbs
* <i>Carpobrotus edulis</i>	0.1	L	Herbs
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.1	L	Herbs
* <i>Cyperus tenellus</i>	0.1	L	Herbs
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	0.1	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
<i>Haemodorum spicatum</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
<i>Levenhookia stipitata</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
* <i>Orobanche minor</i>	0.1	L	Herbs
* <i>Petrorhagia dubia</i>	0.1	L	Herbs
<i>Podotheca chrysantha</i>	0.1	L	Herbs
<i>Siloxerus humifusus</i>	0.1	L	Herbs
* <i>Sonchus oleraceus</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Wahlenbergia capensis</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	1	L	Sedges

Site number	Date	Site type	Observer
ELA_02	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376338	6499569
Condition	Disturbance	Fire (years)	Geology
Excellent	Weeds/ grazing	Young (<5)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia attenuata</i>	6	U	Trees under 10 m
<i>Banksia menziesii</i>	5	U	Trees under 10 m
<i>Macrozamia riedlei</i>	2	M	Shrubs 1 - 2 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.25	M	Shrubs 1 - 2 m
<i>Hibbertia hypericoides</i>	25	M	Shrubs under 1 m
<i>Xanthorrhoea preissii</i>	2	M	Shrubs under 1 m
<i>Petrophile macrostachya</i>	1	M	Shrubs under 1 m
<i>Hakea lissocarpha</i>	0.75	M	Shrubs under 1 m
<i>Conostephium pendulum</i>	0.25	M	Shrubs under 1 m
<i>Leptospermum spinescens</i>	0.25	M	Shrubs under 1 m
<i>Calothamnus quadrifidus</i>	0.1	M	Shrubs under 1 m
<i>Gompholobium tomentosum</i>	0.1	M	Shrubs under 1 m
<i>Persoonia saccata</i>	0.1	M	Shrubs under 1 m
<i>Austrostipa flavescens</i>	0.75	L	Grasses
<i>Amphipogon turbinatus</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
* <i>Pentameris airoides</i>	0.1	L	Grasses

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>*Vulpia myuros</i>	0.1	L	Grasses
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.75	L	Herbs
<i>Podotheca gnaphalioides</i>	0.25	L	Herbs
<i>Anigozanthos humilis</i>	0.1	L	Herbs
<i>Burchardia congesta</i>	0.1	L	Herbs
<i>*Carpobrotus edulis</i>	0.1	L	Herbs
<i>Conostylis aculeata</i>	0.1	L	Herbs
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.1	L	Herbs
<i>*Conyza sumatrensis</i>	0.1	L	Herbs
<i>*Cyperus tenellus</i>	0.1	L	Herbs
<i>Daucus glochidiatus</i>	0.1	L	Herbs
<i>*Gladiolus caryophyllaceus</i>	0.1	L	Herbs
<i>Homalosciadium homalocarpum</i>	0.1	L	Herbs
<i>*Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
<i>Levenhookia stipitata</i>	0.1	L	Herbs
<i>Lobelia tenuior</i>	0.1	L	Herbs
<i>*Lysimachia arvensis</i>	0.1	L	Herbs
<i>Patersonia occidentalis</i> var. <i>occidentalis</i>	0.1	L	Herbs
<i>*Pelargonium capitatum</i>	0.1	L	Herbs
<i>*Petrohragia dubia</i>	0.1	L	Herbs
<i>Scaevola canescens</i>	0.1	L	Herbs
<i>Siloxerus humifusus</i>	0.1	L	Herbs
<i>*Sonchus oleraceus</i>	0.1	L	Herbs
<i>Thysanotus multiflorus</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
<i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Wahlenbergia capensis</i>	0.1	L	Herbs

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Desmocladus fasciculatus</i>	3	L	Sedges
<i>Mesomelaena pseudostygia</i>	0.1	L	Sedges
<i>Schoenus clandestinus</i>	0.1	L	Sedges

Site number	Date	Site type	Observer
ELA_03	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376324	6499634
Condition	Disturbance	Fire (years)	Geology
Excellent	Weeds	Young (<5)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia menziesii</i>	8	U	Trees under 10 m
<i>Banksia attenuata</i>	0.1	U	Trees under 10 m
<i>Macrozamia riedlei</i>	2	M	Shrubs 1 - 2 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.1	M	Shrubs 1 - 2 m
<i>Hibbertia hypericoides</i>	20	M	Shrubs under 1 m
<i>Xanthorrhoea preissii</i>	6	M	Shrubs 1 - 2 m
<i>Calothamnus quadrifidus</i>	2	M	Shrubs under 1 m
<i>Petrophile macrostachya</i>	0.25	M	Shrubs under 1 m
<i>Gompholobium tomentosum</i>	0.1	M	Shrubs under 1 m
<i>Jacksonia calcicola</i>	0.1	M	Shrubs under 1 m
<i>Persoonia saccata</i>	0.1	M	Shrubs under 1 m
<i>Austrostipa flavescens</i>	0.75	L	Grasses
<i>Amphipogon turbinatus</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
* <i>Pentameris airoides</i>	0.1	L	Grasses
* <i>Vulpia myuros</i>	0.1	L	Grasses
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.75	L	Herbs
<i>Podotheca gnaphalioides</i>	0.25	L	Herbs



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Stackhousia huegelii</i>	0.25	L	Herbs
<i>Anigozanthos humilis</i>	0.1	L	Herbs
<i>Burchardia congesta</i>	0.1	L	Herbs
* <i>Carpobrotus edulis</i>	0.1	L	Herbs
<i>Comesperma calymega</i>	0.1	L	Herbs
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.1	L	Herbs
* <i>Cyperus tenellus</i>	0.1	L	Herbs
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	0.1	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
<i>Haemodorum spicatum</i>	0.1	L	Herbs
* <i>Heliophila pusilla</i>	0.1	L	Herbs
<i>Homalosciadium homalocarpum</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
<i>Levenhookia stipitata</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
<i>Opercularia vaginata</i>	0.1	L	Herbs
<i>Patersonia occidentalis</i> var. <i>occidentalis</i>	0.1	L	Herbs
* <i>Petrorhagia dubia</i>	0.1	L	Herbs
* <i>Romulea rosea</i>	0.1	L	Herbs
<i>Siloxerus humifusus</i>	0.1	L	Herbs
* <i>Sonchus oleraceus</i>	0.1	L	Herbs
<i>Stylidium brunonianum</i>	0.1	L	Herbs
<i>Thysanotus multiflorus</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Wahlenbergia capensis</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	2	L	Sedges

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Desmocladius fasciculatus</i>	0.1	L	Sedges
<i>Schoenus clandestinus</i>	0.1	L	Sedges

Site number	Date	Site type	Observer
ELA_04	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Upland	Limestone	376308	6499739
Condition	Disturbance	Fire (years)	Geology
Excellent	Track/ weeds	Moderate (5-10)	Limestone



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia sessilis</i> var. <i>cygnorum</i>	16	M	Shrubs over 2 m
<i>Hakea trifurcata</i>	5	M	Shrubs over 2 m
<i>Xanthorrhoea preissii</i>	2	M	Shrubs over 2 m
<i>Calothamnus quadrifidus</i>	25	M	Shrubs under 1 m
<i>Hibbertia hypericoides</i>	8	M	Shrubs under 1 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	4	M	Shrubs under 1 m
<i>Jacksonia calcicola</i>	1	M	Shrubs under 1 m
<i>Melaleuca systena</i>	1	M	Shrubs under 1 m
<i>Hakea lissocarpha</i>	0.75	M	Shrubs under 1 m
<i>Gompholobium tomentosum</i>	0.1	M	Shrubs under 1 m
<i>Leucopogon propinquus</i>	0.1	M	Shrubs under 1 m
<i>Austrostipa flavescens</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
<i>Lomandra maritima</i>	0.1	L	Grasses
<i>Microlaena stipoides</i>	0.1	L	Grasses
<i>Poa drummondiana</i>	0.1	L	Grasses
* <i>Vulpia myuros</i>	0.1	L	Grasses

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Lechenaultia linarioides</i>	0.25	L	Herbs
<i>Podotricha gnaphalioides</i>	0.25	L	Herbs
<i>Acanthocarpus preissii</i>	0.1	L	Herbs
<i>Burchardia congesta</i>	0.1	L	Herbs
<i>Conostylis aculeata</i>	0.1	L	Herbs
<i>Desmocladius fasciculatus</i>	0.1	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
<i>Homalosciadium homalocarpum</i>	0.1	L	Herbs
<i>Hovea trisperma</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
<i>Orthrosanthus laxus</i> var. <i>laxus</i>	0.1	L	Herbs
* <i>Pentameris airoides</i>	0.1	L	Herbs
<i>Podotricha chrysantha</i>	0.1	L	Herbs
* <i>Sonchus oleraceus</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Wahlenbergia preissii</i>	0.1	L	Herbs
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	0.1	L	Sedges

Site number	Date	Site type	Observer
ELA_05	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376328	6499802
Condition	Disturbance	Fire (years)	Geology
Excellent	Tracks	Moderate (5-10)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia sessilis</i> var. <i>cygnorum</i>	20	M	Shrubs over 2 m
<i>Hakea trifurcata</i>	8	M	Shrubs over 2 m
<i>Xanthorrhoea preissii</i>	4	M	Shrubs over 2 m
<i>Calothamnus quadrifidus</i>	15	M	Shrubs under 1 m
<i>Hibbertia hypericoides</i>	12	M	Shrubs under 1 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	1	M	Shrubs under 1 m
<i>Hakea lissocarpha</i>	0.75	M	Shrubs under 1 m
<i>Jacksonia calcicola</i>	0.75	M	Shrubs under 1 m
<i>Melaleuca systema</i>	0.5	M	Shrubs under 1 m
<i>Gompholobium tomentosum</i>	0.1	M	Shrubs under 1 m
<i>Leucopogon polymorphus</i>	0.1	M	Shrubs under 1 m
<i>Austrostipa flavescens</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
<i>Microlaena stipoides</i>	0.1	L	Grasses
* <i>Vulpia myuros</i>	0.1	L	Grasses
<i>Acanthocarpus preissii</i>	0.1	L	Herbs
<i>Comesperma calymega</i>	0.1	L	Herbs
<i>Conostylis aculeata</i>	0.1	L	Herbs

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Daucus glochidiatus</i>	0.1	L	Herbs
<i>Desmocladius fasciculatus</i>	0.1	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
<i>Podothea chrysantha</i>	0.1	L	Herbs
* <i>Sonchus oleraceus</i>	0.1	L	Herbs
<i>Stackhousia huegelii</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
<i>Tricoryne elatior</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Wahlenbergia preissii</i>	0.1	L	Herbs
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	0.1	L	Sedges
* <i>Schoenus clandestinus</i>	0.1	L	Sedges

Site number	Date	Site type	Observer
ELA_06	3/11/2016	10 m x 10 m Quadrat	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376248	6499715
Condition	Disturbance	Fire (years)	Geology
Excellent	Tracks/ clearing	Moderate (5-10)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia sessilis</i> var. <i>cygnorum</i>	5	M	Shrubs over 2 m
<i>Hakea trifurcata</i>	4	M	Shrubs over 2 m
<i>Xanthorrhoea preissii</i>	1	M	Shrubs over 2 m
<i>Calothamnus quadrifidus</i>	35	M	Shrubs under 1 m
<i>Hibbertia hypericoides</i>	25	M	Shrubs under 1 m
<i>Jacksonia calcicola</i>	2	M	Shrubs under 1 m
<i>Acacia pulchella</i> var. <i>glaberrima</i>	1	M	Shrubs under 1 m
<i>Melaleuca systena</i>	1	M	Shrubs under 1 m
<i>Hakea lissocarpha</i>	0.75	M	Shrubs under 1 m
<i>Leucopogon polymorphus</i>	0.25	M	Shrubs under 1 m
<i>Banksia dallanneyi</i> var. <i>dallanneyi</i>	0.1	M	Shrubs under 1 m
<i>Austrostipa flavescens</i>	0.1	L	Grasses
* <i>Briza maxima</i>	0.1	L	Grasses
<i>Microlaena stipoides</i>	0.1	L	Grasses
<i>Poa drummondiana</i>	0.1	L	Grasses
<i>Acanthocarpus preissii</i>	0.1	L	Herbs
* <i>Brassica tournefortii</i>	0.1	L	Herbs



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Burchardia congesta</i>	0.1	L	Herbs
<i>Conostylis aculeata</i>	0.1	L	Herbs
<i>Desmocladius fasciculatus</i>	0.1	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
<i>Levenhookia pusilla</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
* <i>Pentameris airoides</i>	0.1	L	Herbs
<i>Podothea chrysanth</i>	0.1	L	Herbs
<i>Siloxerus humifusus</i>	0.1	L	Herbs
* <i>Sonchus oleraceus</i>	0.1	L	Herbs
<i>Stylidium brunonianum</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
<i>Urospermum picroides</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	0.1	L	Sedges
<i>Schoenus clandestinus</i>	0.1	L	Sedges

Site number	Date	Site type	Observer
ELA_07	3/11/2016	Releve	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376405	6499812
Condition	Disturbance	Fire (years)	Geology
Very good	Tracks/ clearing	Old (>10)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia menziesii</i>	15	U	Trees under 10 m
<i>Banksia attenuata</i>	2	U	Trees under 10 m
<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>	4	M	Shrubs over 2 m
<i>Allocasuarina humilis</i>	1	M	Shrubs 1 - 2 m
<i>Hibbertia hypericoides</i>	30	M	Shrubs under 1 m
<i>Xanthorrhoea preissii</i>	0.5	M	Shrubs under 1 m
<i>Leucopogon polymorphus</i>	0.25	M	Shrubs under 1 m
* <i>Briza maxima</i>	1	L	Grasses
* <i>Ehrharta calycina</i>	0.1	L	Grasses
<i>Burchardia congesta</i>	0.25	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
* <i>Hypochaeris glabra</i>	0.1	L	Herbs
* <i>Lysimachia arvensis</i>	0.1	L	Herbs
<i>Podotrochea gnaphalioides</i>	0.1	L	Herbs
<i>Trachymene pilosa</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	0.1	L	Herbs

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Mesomelaena pseudostygia</i>	1	L	Sedges

Site number	Date	Site type	Observer
ELA_08	3/11/2016	Releve	JC
Landform	Soils	Easting	Northing
Low dune upland	Yellow sand	376433	6499944
Condition	Disturbance	Fire (years)	Geology
Very good	Tracks/ clearing	Old (>10)	Limestone/Quartz



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Banksia menziesii</i>	15	U	Trees under 10 m
<i>Banksia attenuata</i>	5	U	Trees under 10 m
<i>Allocasuarina humilis</i>	3	M	Shrubs 1 - 2 m
<i>Hibbertia hypericoides</i>	15	M	Shrubs under 1 m
<i>Xanthorrhoea preissii</i>	0.5	M	Shrubs under 1 m
* <i>Briza maxima</i>	0.1	L	Grasses
<i>Podotheca gnaphalioides</i>	0.25	L	Herbs
* <i>Gladiolus caryophyllaceus</i>	0.1	L	Herbs
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.1	L	Herbs
<i>Mesomelaena pseudostygia</i>	1	L	Sedges

# Appendix I Flora species list

Family	Known name
Aizoaceae	* <i>Carpobrotus edulis</i>
Apiaceae	<i>Daucus glochidiatus</i>
	<i>Homalosciadium homalocarpum</i>
Araliaceae	<i>Trachymene pilosa</i>
Asparagaceae	* <i>Asparagus asparagoides</i>
	<i>Acanthocarpus preissii</i>
	<i>Lomandra maritima</i>
	<i>Thysanotus multiflorus</i>
Asteraceae	* <i>Arctotheca calendula</i>
	* <i>Centaurea melitensis</i>
	* <i>Conyza sumatrensis</i>
	* <i>Hypochaeris glabra</i>
	* <i>Sonchus oleraceus</i>
	* <i>Urospermum picroides</i>
	* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>
	<i>Olearia rudis</i>
	<i>Podotheca gnaphalioides</i>
	<i>Podotheca chrysantha</i>
	<i>Siloxerus humifusus</i>
	<i>Waitzia suaveolens</i> var. <i>suaveolens</i>
Brassicaceae	* <i>Brassica tournefortii</i>
	* <i>Heliophila pusilla</i>
Campanulaceae	* <i>Wahlenbergia capensis</i>
	<i>Lobelia tenuior</i>
	<i>Wahlenbergia preissii</i>
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Casuarinaceae	<i>Allocasuarina humilis</i>
Celastraceae	<i>Stackhousia huegelii</i>
Colchicaceae	<i>Burchardia congesta</i>
Cyperaceae	* <i>Cyperus tenellus</i>

Family	Known name
	<i>Lepidosperma squamatum</i>
	<i>Mesomelaena pseudostygia</i>
	<i>Schoenus clandestinus</i>
Dilleniaceae	<i>Hibbertia hypericoides</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Ericaceae	<i>Conostephium pendulum</i>
	<i>Leucopogon polymorphus</i>
	<i>Leucopogon propinquus</i>
Fabaceae	<i>Acacia pulchella</i> var. <i>glaberrima</i>
	<i>Acacia truncata</i>
	<i>Gompholobium tomentosum</i>
	<i>Hovea trisperma</i>
	<i>Jacksonia calcicola</i>
Geraniaceae	* <i>Pelargonium capitatum</i>
Goodeniaceae	<i>Lechenaultia linarioides</i>
	<i>Scaevola canescens</i>
Haemodoraceae	<i>Anigozanthos humilis</i>
	<i>Conostylis aculeata</i>
	<i>Conostylis setigera</i> subsp. <i>setigera</i>
	<i>Haemodorum spicatum</i>
Hemerocallidaceae	<i>Corynotheca micrantha</i>
	<i>Dianella revoluta</i>
	<i>Tricoryne elatior</i>
Iridaceae	* <i>Gladiolus caryophyllaceus</i>
	* <i>Romulea rosea</i>
	<i>Orthrosanthus laxus</i> var. <i>laxus</i>
	<i>Patersonia occidentalis</i> var. <i>occidentalis</i>
Myrtaceae	<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>
	<i>Eucalyptus tottiana</i>
	<i>Kunzea glabrescens</i>
	<i>Leptospermum spinescens</i>
	<i>Melaleuca systema</i>



Family	Known name
Orobanchaceae	<i>*Orobanche minor</i>
Phyllanthaceae	<i>Phyllanthus calycinus</i>
Poaceae	<i>*Avena barbata</i>
	<i>*Briza maxima</i>
	<i>*Ehrharta calycina</i>
	<i>*Ehrharta longiflora</i>
	<i>*Pentameris airoides</i>
	<i>*Vulpia myuros</i>
	<i>Amphipogon turbinatus</i>
	<i>Austrostipa flavescens</i>
	<i>Microlaena stipoides</i>
	<i>Poa drummondiana</i>
Polygalaceae	<i>Comesperma calymega</i>
Primulaceae	<i>*Lysimachia arvensis</i>
Proteaceae	<i>Adenanthos cygnorum</i>
	<i>Banksia attenuata</i>
	<i>Banksia menziesii</i>
	<i>Banksia sessilis</i> var. <i>cygnorum</i>
	<i>Banksia dallanneyi</i> var. <i>dallanneyi</i>
	<i>Grevillea vestita</i> (Endl.) Meisn. subsp. <i>vestita</i>
	<i>Hakea lissocarpha</i>
	<i>Hakea ruscifolia</i>
	<i>Hakea trifurcata</i>
	<i>Persoonia saccata</i>
	<i>Petrophile macrostachya</i>
	<i>Synaphea spinulosa</i>
Restionaceae	<i>Desmocladius fasciculatus</i>
Rhamnaceae	<i>Spyridium globulosum</i>
Rubiaceae	<i>Opercularia vaginata</i>
Solanaceae	<i>Anthocercis littorea</i>
Stylidiaceae	<i>Levenhookia pusilla</i>
	<i>Levenhookia stipitata</i>

Family	Known name
Stylidiaceae	<i>Stylidium brunonianum</i>
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>
Zamiaceae	<i>Macrozamia riedlei</i>

## Appendix J Flora species matrix

Species	Vegetation community							
	BaBmLW					BsXpHtTOS		
	But01	But02	But03	But07	But08	But04	But05	But06
<i>*Avena barbata</i>	1	0	0	0	0	0	0	0
<i>*Brassica tournefortii</i>	0	0	0	0	0	0	0	1
<i>*Briza maxima</i>	1	1	1	1	1	1	1	1
<i>*Carpobrotus edulis</i>	1	1	1	0	0	0	0	0
<i>*Conyza sumatrensis</i>	0	1	0	0	0	0	0	0
<i>*Cyperus tenellus</i>	1	1	1	0	0	0	0	0
<i>*Ehrharta calycina</i>	1	0	0	1	0	0	0	0
<i>*Ehrharta longiflora</i>	1	0	0	0	0	0	0	0
<i>*Gladiolus caryophyllaceus</i>	1	1	1	1	1	1	1	1
<i>*Heliophila pusilla</i>	0	0	1	0	0	0	0	0
<i>*Hypochaeris glabra</i>	1	1	1	1	0	1	1	1
<i>*Lysimachia arvensis</i>	1	1	1	1	0	1	1	1
<i>*Orobancha minor</i>	1	0	0	0	0	0	0	0
<i>*Pelargonium capitatum</i>	0	1	0	0	0	0	0	0
<i>*Pentameris airoides</i>	1	1	1	0	0	1	0	1
<i>*Petrohragia dubia</i>	1	1	1	0	0	0	0	0
<i>*Romulea rosea</i>	0	0	1	0	0	0	0	0
<i>*Sonchus oleraceus</i>	1	1	1	0	0	1	1	1
<i>*Urospermum picroides</i>	0	0	0	0	0	0	0	1
<i>*Ursinia anthemoides subsp. anthemoides</i>	1	1	1	1	1	1	1	1
<i>*Vulpia myuros</i>	1	1	1	0	0	1	1	0
<i>*Wahlenbergia capensis</i>	1	1	1	0	0	0	0	0
<i>Acacia pulchella var. glaberrima</i>	1	1	1	0	0	1	1	1
<i>Acanthocarpus preissii</i>	0	0	0	0	0	1	1	1
<i>Allocasuarina humilis</i>	1	0	0	1	1	0	0	0
<i>Amphipogon turbinatus</i>	1	1	1	0	0	0	0	0
<i>Anigozanthos humilis</i>	0	1	1	0	0	0	0	0
<i>Austrostipa flavescens</i>	1	1	1	0	0	1	1	1
<i>Banksia attenuata</i>	1	1	1	1	1	0	0	0
<i>Banksia menziesii</i>	1	1	1	1	1	0	0	0
<i>Banksia sessilis var. cygnorum</i>	0	0	0	0	0	1	1	1
<i>Banksia dallanneyi var. dallanneyi</i>	0	0	0	0	0	0	0	1
<i>Burchardia congesta</i>	1	1	1	1	0	1	0	1
<i>Calothamnus quadrifidus subsp. quadrifidus</i>	0	1	1	1	0	1	1	1
<i>Comesperma calymega</i>	0	0	1	0	0	0	1	0

Species	Vegetation community							
	BaBmLW					BsXpHtTOS		
	But01	But02	But03	But07	But08	But04	But05	But06
<i>Conostephium pendulum</i>	0	1	0	0	0	0	0	0
<i>Conostylis aculeata</i>	0	1	0	0	0	1	1	1
<i>Conostylis setigera</i> subsp. <i>setigera</i>	1	1	1	0	0	0	0	0
<i>Daucus glochidiatus</i>	0	1	0	0	0	0	1	0
<i>Desmocladius fasciculatus</i>	0	1	1	0	0	1	1	1
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	1	0	1	0	0	0	0	0
<i>Gompholobium tomentosum</i>	1	1	1	0	0	1	1	0
<i>Haemodorum spicatum</i>	1	0	1	0	0	0	0	0
<i>Hakea lissocarpha</i>	0	1	0	0	0	1	1	1
<i>Hakea trifurcata</i>	0	0	0	0	0	1	1	1
<i>Hibbertia hypericoides</i>	1	1	1	1	1	1	1	1
<i>Homalosciadium homalocarpum</i>	0	1	1	0	0	1	0	0
<i>Hovea trisperma</i>	0	0	0	0	0	1	0	0
<i>Jacksonia calcicola</i>	0	0	1	0	0	1	1	1
<i>Lechenaultia linarioides</i>	0	0	0	0	0	1	0	0
<i>Leptospermum spinescens</i>	0	1	0	0	0	0	0	0
<i>Leucopogon polymorphus</i>	1	0	0	1	0	0	1	1
<i>Leucopogon propinquus</i>	0	0	0	0	0	1	0	0
<i>Levenhookia pusilla</i>	1	1	1	0	0	1	1	1
<i>Levenhookia stipitata</i>	1	1	1	0	0	0	0	0
<i>Lobelia tenuior</i>	0	1	0	0	0	0	0	0
<i>Lomandra maritima</i>	0	0	0	0	0	1	0	0
<i>Macrozamia riedlei</i>	0	1	1	0	0	0	0	0
<i>Melaleuca systema</i>	0	0	0	0	0	1	1	1
<i>Mesomelaena pseudostygia</i>	1	1	1	1	1	1	1	1
<i>Microlaena stipoides</i>	0	0	0	0	0	1	1	1
<i>Opercularia vaginata</i>	0	0	1	0	0	0	0	0
<i>Orthrosanthus laxus</i> var. <i>laxus</i>	0	0	0	0	0	1	0	0
<i>Patersonia occidentalis</i> var. <i>occidentalis</i>	0	1	1	0	0	0	0	0
<i>Persoonia saccata</i>	0	1	1	0	0	0	0	0
<i>Petrophile macrostachya</i>	0	1	1	0	0	0	0	0
<i>Poa drummondiana</i>	0	0	0	0	0	1	0	1
<i>Podotheca chrysantha</i>	1	0	0	0	0	1	1	1
<i>Podotheca gnaphalioides</i>	1	1	1	1	1	1	0	0
<i>Scaevola canescens</i>	0	1	0	0	0	0	0	0
<i>Schoenus clandestinus</i>	0	1	1	0	0	0	1	1
<i>Siloxerus humifusus</i>	1	1	1	0	0	0	0	1

Species	Vegetation community							
	BaBmLW					BsXpHtTOS		
	But01	But02	But03	But07	But08	But04	But05	But06
<i>Stackhousia huegelii</i>	0	0	1	0	0	0	1	0
<i>Stylidium brunonianum</i>	0	0	1	0	0	0	0	1
<i>Thysanotus multiflorus</i>	0	1	1	0	0	0	0	0
<i>Trachymene pilosa</i>	1	1	1	1	0	1	1	1
<i>Tricoryne elatior</i>	0	0	0	0	0	0	1	0
<i>Wahlenbergia preissii</i>	0	0	0	0	0	1	1	0
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	1	1	1	1	0	1	1	1
<i>Xanthorrhoea preissii</i>	1	1	1	1	1	1	1	1

## Appendix K Introduced flora (weed) species list

Family	Species name
Aizoaceae	* <i>Carpobrotus edulis</i>
Asparagaceae	* <i>Asparagus asparagoides</i>
Asteraceae	* <i>Arctotheca calendula</i>
	* <i>Centaurea melitensis</i>
	* <i>Conyza sumatrensis</i>
	* <i>Hypochaeris glabra</i>
	* <i>Sonchus oleraceus</i>
	* <i>Urospermum picroides</i>
	* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>
Brassicaceae	* <i>Brassica tournefortii</i>
	* <i>Heliophila pusilla</i>
Campanulaceae	* <i>Wahlenbergia capensis</i>
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Cyperaceae	* <i>Cyperus tenellus</i>
Geraniaceae	* <i>Pelargonium capitatum</i>
Iridaceae	* <i>Gladiolus caryophyllaceus</i>
	* <i>Romulea rosea</i>
Orobanchaceae	* <i>Orobanche minor</i>
Poaceae	* <i>Avena barbata</i>
	* <i>Briza maxima</i>
	* <i>Ehrharta calycina</i>
	* <i>Ehrharta longiflora</i>
	* <i>Pentameris airoides</i>
	* <i>Vulpia myuros</i>
Primulaceae	* <i>Lysimachia arvensis</i>



## Appendix L Fauna species list

Species	Common name
Birds	
<i>Cracticus tibicen</i>	Australian Magpie
<i>Eolophus roseicapilla</i>	Galah
<i>Anthochaera carunculata</i>	Red wattlebird
<i>Falco cenchroides</i>	Nankeen Kestrel
<i>Haliastur sphenurus</i>	Whistling Kite
<i>Spilopelia senegalensis</i>	Laughing Turtle-dove
<i>Cracticus torquatus</i>	Grey Butcherbird
<i>Lichmera indistincta</i>	Brown honeyeater
<i>Barnardius zonarius</i>	Australian Ringneck parrot
<i>Grallina cyanoleuca</i>	Magpie-lark
<i>Corvus coronoides</i>	Australian Raven
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Phylidonyris niger</i>	White-cheeked Honeyeater
Mammals	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo
* <i>Oryctolagus cuniculus</i>	European rabbit
* <i>Vulpes vulpes</i>	Fox
Reptiles	
<i>Tiliqua rugosa</i>	Bobtail

## Appendix M Fauna photos



*Merops ornatus* (Rainbow Bee-eater)



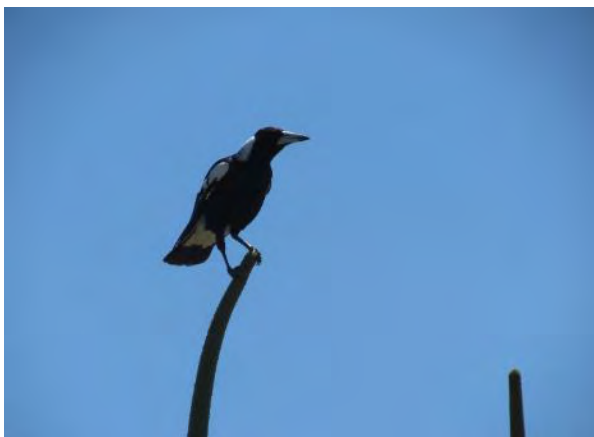
Rainbow Bee-eaters and burrow (nest)



Chewed *Banksia* cones



*Phylidonyris niger* (White-cheeked Honeyeater)



*Cracticus tibicen* (Australian Magpie)



*Tiliqua rugosa* (Bob-tail)



*Barnardius zonarius* (Australian Ringneck Parrot)



European Fox Skull (Jaw bone)



Red Kangaroo scats



European Rabbit scats and diggings

## Appendix N Black Cockatoo foraging evidence locations

Type of evidence	Location (Co-ordinates in UTM)	
	Northing	Easting
Foraging (chewed <i>Banksia</i> cones)	6499540	376442
Foraging (chewed <i>Banksia</i> cones)	6499530	376332
Foraging (chewed <i>Banksia</i> cones)	6499553	376530
Foraging (chewed <i>Banksia</i> cones)	6499545	376300
Foraging (chewed <i>Banksia</i> cones)	6499590	376381
Foraging (chewed <i>Banksia</i> cones)	6499630	376419
Foraging (chewed <i>Banksia</i> cones)	6499748	376429
Foraging (chewed <i>Banksia</i> cones)	6499925	376383
Foraging (chewed <i>Banksia</i> cones)	6499930	376344
Foraging (chewed <i>Banksia</i> cones)	6499863	376448
Foraging (chewed <i>Banksia</i> cones)	6499802	376386





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