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# NEERABUP INDUSTRIAL AREA ENVIRONMENTAL ASSESSMENTS – PORTION 2

City of Wanneroo

**ecoscape**



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## SUMMARY

The City of Wanneroo (the City) has an approved Clearing Permit CPS 6359 for 10ha of Lot 600 Wattle Ave and this survey is required for the lodgement of a new clearing permit application for the remaining 37ha proposed for the development of a solar power energy generation facility. The City has requested a biological survey comprising a Basic Fauna survey and a Detailed Flora and Vegetation survey to support the clearing permit application for this site.

A desktop assessment was conducted prior to the field surveys and the results include the following significant findings:

- two known Threatened Ecological Communities and five Priority Ecological Communities occur within an 8 km buffer of the survey area. Based on information available in the desktop assessment, the *Banksia Woodlands of the Swan Coastal Plain* TEC/PEC was considered likely to occur within the survey area
- three Threatened flora, three Priority 1, four Priority 2, six Priority 3 and three Priority 4 flora occur within the search area buffer. Of these, four were considered 'Possible' to occur within the survey area based on a likelihood assessment: *Drosera patens* (P1), *Calectasia elegans* (P2), *Poranthera moorokatta* (P2) and *Stenanthemum sublineare* (P2)
- five conservation-listed vertebrate fauna were identified as having previously been recorded from within a buffer of 4 km (two mammals and three birds). Of these, one was previously recorded within the survey area (*Calyptorhynchus latirostris*) and three were assessed as having a 'High' likelihood of occurring (*Calyptorhynchus banksii naso*, *Notamacropus irma* and *Isoodon fusciventer*).

The flora and vegetation survey was conducted over two days from 29-30 October 2020 with the following significant findings:

- a total of 113 vascular flora were recorded from 93 genera and 39 families. Of these, 26 were weed species including two significant weeds (*\*Asparagus asparagoides* and *\*Moraea miniata*). No Threatened or Priority flora were recorded within the survey area
- four vegetation types were recorded within the survey area. Two of the vegetation types (**BaMW** and **BiMW**) had patches that met the criteria for inclusion in the *Banksia Woodlands of the Swan Coastal Plain* TEC/PEC
- most of the vegetation within the survey area was assessed as Degraded with better condition vegetation occurring in the northern section (west and east of the go kart track) in vegetation types **BaMW** and **BiMW**.

The fauna survey was conducted on 29 October 2020 with the following significant findings:

- a total of 18 vertebrate fauna species were recorded from within the survey area. No conservation-listed fauna other than the Rainbow Bee-eater (EPBC-listed as Marine) were recorded. However, the *Banksia* Woodland has suitable habitat for conservation-listed species to occur, such as Black Cockatoos and Quenda
- two fauna habitat types were recorded within the survey area: *Banksia* Woodland and Degraded Woodland (*Eucalyptus tottiana*, *Melaleuca preissiana*, *Eucalyptus rudis*)
- a total of 19 Black Cockatoo breeding habitat trees were recorded within the survey area consisting of *Eucalyptus marginata* (three) and *Eucalyptus rudis* (16). The survey area also contains foraging habitat for Black Cockatoos which was assessed as 'High' and 'Very High' quality for Carnaby's and Forest Red-tailed Cockatoos, respectively.

# ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

| Acronyms and abbreviations   |                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>BAM Act</b>               | Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>                                  |
| <b>BC Act</b>                | Western Australian <i>Biodiversity Conservation Act 2016</i>                                               |
| <b>BoM</b>                   | Bureau of Meteorology                                                                                      |
| <b>CD</b>                    | Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)            |
| <b>CR</b>                    | Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)                |
| <b>DAFWA</b>                 | Department of Agriculture and Food, Western Australia (2006-2017, now DPIRD)                               |
| <b>DAWE</b>                  | Commonwealth Department of Agriculture, Water and Environment (2020-)                                      |
| <b>DBCA</b>                  | Western Australian Department of Biodiversity, Conservation and Attractions                                |
| <b>DBH</b>                   | Diameter at Breast Height (1.3 m)                                                                          |
| <b>DEWHA</b>                 | Department of Environment, Water, Heritage, and the Arts                                                   |
| <b>DMIRS</b>                 | Western Australian Department of Mines, Industry Regulation and Safety                                     |
| <b>DPaW</b>                  | Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)                                  |
| <b>DoE</b>                   | Commonwealth Department of the Environment (2013-2016, now DAWE)                                           |
| <b>DotEE</b>                 | Commonwealth Department of the Environment and Energy (2016-2020)                                          |
| <b>DPIRD</b>                 | Western Australian Department of Primary Industries and Rural Development                                  |
| <b>DWER</b>                  | Western Australian Department of Water and Environmental Regulation                                        |
| <b>EN</b>                    | Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)                           |
| <b>Ecoscape</b>              | Ecoscape (Australia) Pty Ltd                                                                               |
| <b>EP Act</b>                | Western Australian <i>Environmental Protection Act 1986</i>                                                |
| <b>EPA</b>                   | Western Australian Environmental Protection Authority                                                      |
| <b>EPBC Act</b>              | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>                          |
| <b>GDA 94</b>                | Geographic Datum of Australia 1994                                                                         |
| <b>GIS</b>                   | Geographic Information System                                                                              |
| <b>GPS</b>                   | Global Positioning System                                                                                  |
| <b>GWA</b>                   | Government of Western Australia                                                                            |
| <b>ha</b>                    | hectare/hectares                                                                                           |
| <b>IBRA</b>                  | Interim Biogeographic Regionalisation for Australia                                                        |
| <b>IUCN</b>                  | International Union for Conservation of Nature                                                             |
| <b>km</b>                    | kilometre/kilometres                                                                                       |
| <b>m</b>                     | metre/metres                                                                                               |
| <b>MGA</b>                   | Map Grid of Australia                                                                                      |
| <b>MI</b>                    | Migratory species (fauna; specially protected species under the Western Australian BC Act)                 |
| <b>NVIS</b>                  | National Vegetation Inventory System                                                                       |
| <b>MNES</b>                  | Matters of National Environmental Significance                                                             |
| <b>OEPA</b>                  | Office of the Environmental Protection Authority                                                           |
| <b>OS</b>                    | Other specially protected species (fauna; specially protected species under the Western Australian BC Act) |
| <b>P; P1, P2, P3, P4, P5</b> | Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)               |
| <b>PEC</b>                   | Priority Ecological Community                                                                              |
| <b>PA</b>                    | Potential Black Cockatoo breeding trees with available hollows                                             |
| <b>PF</b>                    | Priority Flora                                                                                             |
| <b>PMST</b>                  | Protected Matters Search Tool (hosted by DAWE, used to search for MNES)                                    |
| <b>PN</b>                    | Potential Black Cockatoo breeding trees without hollows                                                    |



| <b>Acronyms and abbreviations</b> |                                                                                               |
|-----------------------------------|-----------------------------------------------------------------------------------------------|
| <b>PU</b>                         | Potential Black Cockatoo breeding trees with unavailable hollows                              |
| <b>sp.</b>                        | Species (generally referring to an unidentified taxon or when a phrase name has been applied) |
| <b>subsp.</b>                     | Subspecies (infrataxon)                                                                       |
| <b>S1</b>                         | Schedule 1 Fauna species listed under the BC Act                                              |
| <b>TEC</b>                        | Threatened Ecological Community                                                               |
| <b>T</b>                          | Threatened Fauna species listing by DBCA                                                      |
| <b>TF</b>                         | Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)             |
| <b>var.</b>                       | Variety (infrataxon)                                                                          |
| <b>VU</b>                         | Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)              |
| <b>WAH</b>                        | Western Australian Herbarium                                                                  |
| <b>WAM</b>                        | Western Australian Museum                                                                     |
| <b>WAOL</b>                       | Western Australian Organism List                                                              |
| <b>WONS</b>                       | Weeds of National Significance                                                                |
| <b>*</b>                          | Introduced flora species (i.e. weed)                                                          |

# 1 INTRODUCTION

## 1.1 BACKGROUND

The City of Wanneroo (the City) has an approved Clearing Permit CPS 6359 for 10 ha of Lot 600 Wattle Ave and this survey is required for the lodgement of a new clearing permit application for the remaining 37 ha proposed for the development of a solar power energy generation facility. The City has requested a biological survey to support the clearing permit application for this site. The requirements of the survey are:

- a Basic Fauna survey including the following tasks as a minimum:
  - desktop assessment
  - field survey by suitably experienced and qualified personnel
  - submission of data in accordance with the EPA's IBSA (Index of Biodiversity Surveys for Assessments) requirements
  - a fauna report including maps and data in shapefile format.
- a single-phase Detailed Flora and Vegetation survey conducted in accordance with the following:
  - Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)
  - Keighery vegetation condition scale (Keighery 1994)
  - the use of multiple quadrats at representative points throughout each preliminary vegetation type, opportunistic collections, systematic transects and targeted inspections of potential habitat.

## 1.2 SURVEY AREA

The Lot 600 project area, known as the 'survey area' in this report, is located within the City of Wanneroo in the Swan Coastal Plain region approximately 31 km north of Perth (**Figure 1**). The survey area is approximately 47.30 ha in size and consists of a go kart track in the north and open forest and woodland vegetation.



**Figure 1: Survey area location**

### 1.3 COMPLIANCE

This biological assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Western Australian *Animal Welfare Act 2002*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- DSEWPaC (2012) *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*, known in this document as the Black Cockatoo Referral Guidelines*
- Commonwealth of Australia (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, known in this document as the Revised Draft Referral Guideline*
- Threatened Species Scientific Committee (TSSC 2016) *Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*
- Department of the Environment and Energy (DotEE 2019) *Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community.*

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020a) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2020b) *Statement of Environmental Principles, Factors and Objectives.*

#### 1.3.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities, and heritage areas listed under the Act. Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 16** in **Appendix One**. Threatened Ecological Communities are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

#### 1.3.2 WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement, and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

### 1.3.3 WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 17** of **Appendix One**. These categories align with those within the EPBC Act.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to, or recovering from, a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as specially protected species in the BC Act.

The most recent flora and fauna listings were published in the *Government Gazette* on 11 September 2018 (Government of Western Australia 2018a).

## 1.4 FLORA

### 1.4.1 THREATENED AND PRIORITY FLORA

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as Threatened by the Western Australian DBCA and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 16** in **Appendix One** for conservation status category descriptions).

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are seven categories covering Western Australian-listed TF and PF species which are outlined in **Table 17** in **Appendix One**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 17**.

### 1.4.2 OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

### 1.4.3 INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2020) and are designated with an asterisk (\*) in this document.

#### 1.4.3.1 Weeds of National Significance

At a national level there are 36 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2020). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

#### 1.4.3.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

## 1.5 ECOLOGICAL COMMUNITIES/VEGETATION

Most, although not all, conservation-listed ecological communities are defined by vegetation, usually within the context of a defined landform or unique habitat. Although 'vegetation' and 'ecological communities' are not interchangeable terms, this assessment describes the vegetation of the survey area with conservation status taking into consideration the interactions of the vegetation with the biological and physical environment within which it occurs (i.e. the ecological community as a whole).

### 1.5.1 EPBC-LISTED THREATENED ECOLOGICAL COMMUNITIES

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (DBCA 2020). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. Ecological communities are categorised as Critically Endangered, Endangered and Vulnerable as described in **Table 16** in **Appendix One**.

### 1.5.2 WESTERN AUSTRALIAN THREATENED ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act. TECs are categorised much like those of the EPBC Act, shown in **Table 18** in **Appendix One**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June in June 2018 (DBCA 2018).

### 1.5.3 WESTERN AUSTRALIAN PRIORITY ECOLOGICAL COMMUNITIES

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 5 May 2020 (Species and Communities Program; DBCA 2020).

### 1.5.4 OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

## 1.6 FAUNA

### 1.6.1 EPBC-LISTED THREATENED FAUNA

At a Commonwealth level, Threatened Fauna are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 16** in **Appendix One**).

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DotEE 2020):

*Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.*

Species listed by the following international agreements are currently protected under the EPBC Act:

- *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)

- *China-Australia Migratory Bird Agreement* (CAMBA)
- *Japan-Australia Migratory Bird Agreement* (JAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement* (ROKAMBA).

### 1.6.2 WESTERN AUSTRALIAN BC ACT-LISTED FAUNA

Threatened fauna that meet the categories listed within the BC Act are protected and require authorisation by the Minister to take or disturb. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act.

Fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. These are known as Specially Protected Species in the BC Act.

The categories covering State-listed threatened fauna species are outlined in **Table 17** in **Appendix One**.

### 1.6.3 WESTERN AUSTRALIAN PRIORITY FAUNA

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 17** in **Appendix One**.

## 1.7 ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas around Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

## 1.8 CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate, and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).



## 2 EXISTING ENVIRONMENT (DESKTOP ASSESSMENT)

### 2.1 PHYSICAL ENVIRONMENT

#### 2.1.1 CLIMATE

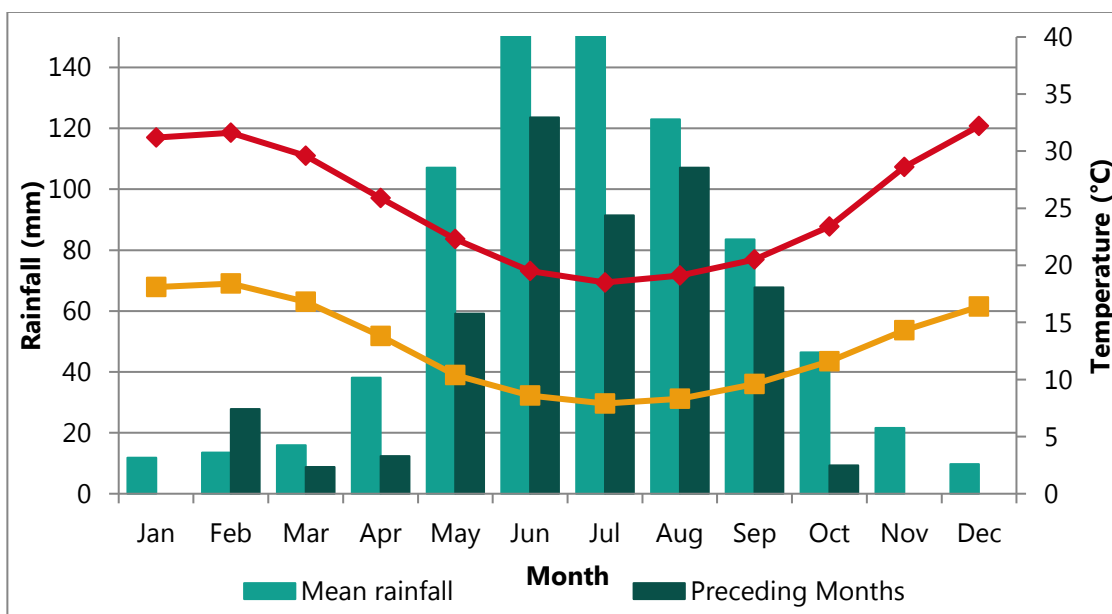
The southwest of Western Australia is generally described as having a Mediterranean-type climate of mild, wet winters and warm to hot, dry summers. The climate of the region is strongly influenced by the position of a band of high pressure known as the sub-tropical ridge. For much of the year the ridge is located to the south allowing the east or south easterly winds to prevail. During the cooler months the ridge periodically moves to the north allowing cold fronts to pass over the west coast and deliver much of the annual rainfall (Beard 1990).

According to the Köppen-Geiger climate classification, the survey area has a temperate climate with hot, dry summers (Class Csa) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a Mediterranean climate where average summer maximum temperatures exceed 22°C and the average coldest month maximum is between 18 and -3°C, and summer rainfall is less than one third of winter rainfall.

The closest Bureau of Meteorology (BoM) station with long term records for rainfall is Wanneroo (station 9105, operating since 1905) (BoM 2020) located approximately 7 km from the survey area. The mean annual rainfall is 793.60 mm, of which 70% falls in the winter months from May to August.

The closest BoM station with long term records for temperature is Perth Metro (station 9225) located approximately 19.9 km from the survey area. February is the hottest month with a mean maximum temperature of 31.6°C and minimum of 18.4°C. July is the coldest month with a mean maximum of 18.5°C and minimum of 7.9°C.

**Figure 2** shows the average rainfall and temperatures of the survey area, with rainfall for the months preceding the field survey. The rainfall in the six months prior to the survey was below average (65% of the mean rainfall for this period).



**Figure 2: Rainfall and temperature data for the survey area**

### 2.1.2 LAND SYSTEMS

According to Department of Primary Industries and Rural Development (DPIRD 2020) soil landscape mapping, the following land systems intersect the survey area (**Table 2** and **Map 1**).

**Table 2: Land systems (DPIRD 2020)**

| Mapping unit | Land system                  | Description                                                                                                                                                                                                | Extent (ha) | %     |
|--------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|
| 211Sp        | Karrakatta Sand Yellow Phase | Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m. <i>Banksia</i> spp. woodland with scattered emergent <i>E. gomphocephala</i> and <i>E. marginata</i> and a dense shrub layer. | 3.79        | 8.01  |
| 211Sp        | Karrakatta Sand Grey Phase   | Low hilly to gently undulating terrain. Iron podzols. <i>Banksia</i> spp woodland with <i>E. todtiana</i> and depauperate <i>E. marginata</i> , dense shrub layer.                                         | 43.51       | 91.99 |

### 2.1.3 GEOLOGY

The survey area corresponds with the Muchea map sheet of the 1:50,000 Geological series maps (DMIRS 2020). The geological units that intersect the survey area are shown in **Table 3**.

**Table 3: Geology**

| Mapping unit | Description                                                                                                                                 | Extent (ha) | %     |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|
| S7           | SAND - pale and olive-yellow medium to coarse-grained sub-angular quartz moderately sorted of residual origin modified by marine inundation | 46.89       | 99.13 |
| S4           | SAND - greyish brown medium to coarse-grained quartz variable silt content moderately well sorted of lacustrine origin                      | 0.41        | 0.87  |

### 2.1.4 WETLANDS AND DRAINAGE

The survey area is in the Swan Avon Lower Swan catchment and partially intersects the Lake Pinjar geomorphic wetland in the south east (**Map 1**). No drainage lines or other hydrological features intersect the survey area.

### 2.1.5 GROUNDWATER DEPENDENT ECOSYSTEMS

The Groundwater Dependent Ecosystems Atlas (Australian Government & BoM 2020) indicates that the survey area is considered as low and medium potential for terrestrial GDEs to occur, with an IDE likelihood of six, eight and 10.

### 2.1.6 ENVIRONMENTALLY SENSITIVE AREAS

The survey area intersects ESAs in the north and east, with the eastern section most likely associated with the Lake Pinjar geomorphic wetland. The ESA that intersects in the north corresponds with Bush Forever sites 428 and 382.

### 2.1.7 CONSERVATION LANDS

The survey area does not intersect any conservation lands but is immediately adjacent to the Gngangara-Moore Rive State Forest conservation estate in the north (**Map 2**).

## 2.2 BIOLOGICAL ENVIRONMENT

### 2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Department of Agriculture Water and the Environment 2020).

The survey area is located in the Swan Coastal Plain IBRA region in the Perth subregion (SWA2), described as:

*a low lying coastal plain, mainly covered with woodlands. It is 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. The climate is Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by C. obesa-marri woodlands and Melaleuca shrublands, are extensive only in the south. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia, and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials. Includes a complex series of seasonal wetlands and also includes Rottnest, Carnac, and Garden Islands etc. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean. The subregional area is 1, 333, 901 ha.*

### 2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019). Extents are updated every two years by DBCA (2019a). This mapping indicates that the survey areas intersects one pre-European vegetation unit, Association 6 (Spearwood): Jarrah, marri, and wandoo *Eucalyptus marginata*, *Corymbia calophylla*, *E. wandoo*.

The pre-European vegetation association identified from the survey area (DPIRD 2019) and its pre-European and current extents are listed in **Table 4** (DBCA 2019a).

**Table 4: Pre-European vegetation association representation (DBCA 2019a)**

| Region                                         | Vegetation association | Original extent (ha) | Current extent (ha) | % remaining |
|------------------------------------------------|------------------------|----------------------|---------------------|-------------|
| Western Australia                              | 6                      | 56,343.01            | 13,362.25           | 23.72       |
| IBRA biogeographic region (Swan Coastal Plain) | 6                      | 56,343.01            | 13,362.25           | 23.72       |
| IBRA biogeographic sub-region (Perth)          | 6                      | 56,343.01            | 13,362.25           | 23.72       |
| LGA (City of Wanneroo)                         | 6                      | 12,662.10            | 2,777.67            | 21.94       |

### 2.2.3 HEDDLE VEGETATION COMPLEXES

Heddle *et al.* (1980) divided the Swan Coastal Plain into medium to large areas based on soil and landform units, with the vegetation within these areas defined in terms of floristic composition, growth-form dominance, species composition and stratal structure.

According to Heddle *et al.* (1980), two vegetation complexes correspond with the survey area (**Map 2**):

- Karakatta Complex – Central and South (99.66% of survey area): Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River
- Pinjar Complex (0.34% of survey area): Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species to a fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca preissiana* (Moonah) and sedgeland.

### 2.2.4 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Protected Matters Search Tool (PMST) search (Australian Government & DAWE 2020; search reference REUQ47) using a 8 km buffer around a point approximating the centre of the survey area, identified:

- two EPBC-listed TECs likely to occur:
  - *Banksia* Woodlands of the Swan Coastal Plain ecological community
  - Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community.

The DBCA database search (search reference 20145 clipped to an appropriate buffer of 8 km) identified the following TECs and PECs within the search area buffer:

- *Banksia attenuata* woodland over species rich dense shrublands (EPBC Act Endangered TEC, BC Act Endangered TEC)
- *Banksia ilicifolia* woodlands (EPBC Act Endangered TEC, Priority 3 PEC)
- *Banksia* Woodlands of the Swan Coastal Plain (EPBC Act Endangered TEC, Priority 3 PEC)
- *Melaleuca huegelii* - *Melaleuca systema* shrublands on limestone ridges (BC Act Endangered)
- Northern Spearwood shrublands and woodlands (Priority 3 PEC)
- Southern *Eucalyptus gomphocephala*-*Agonis flexuosa* woodlands (Priority 3 PEC)
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (EPBC Act Critically Endangered TEC, Priority 3 PEC).

**Map 3** shows the locations of ecological communities identified by the DBCA database search.

#### ***Banksia* Woodlands of the Swan Coastal Plain**

Some TECs listed under the EPBC Act have detailed assessment methodologies to determine if vegetation is representative. The *Banksia* Woodlands of the Swan Coastal Plain TEC/PEC is likely to occur within the survey area and the following was referred to when making a determination for inclusion in the TEC:

- TSSC (2016) *Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*.

Further information, including criteria and thresholds for inclusion are summarised in **Appendix Two**.

### 2.2.5 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified two EPBC-listed Threatened Flora (TF) that are known to occur within the 8 km search buffer area, five as 'species or habitat likely to occur within area' and six as 'species or habitat that may occur within area'.

The requested DBCA database search (search reference 07-0720FL) was conducted using a buffer clipped to 8 km around the survey area. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium.

**Map 3** shows the locations of conservation-listed flora identified by the DBCA database search.

The combined database searches identified the species listed in **Table 25** in **Appendix Three**, consisting of three TF (two from records known to occur within the database search buffer), three P1, four P2, six P3 and three P4.

#### 2.2.5.1 Threatened and Priority Flora Likelihood Assessment

Ecoscope conducted a likelihood assessment to identify TF and PF species that have potential to occur within the survey area. The likelihood of a species occurring is based on the following attributes, as listed on *FloraBase* (WAH 1998-2020, 2020, including specimen collection information), incorporating an assessment of habitats likely to be present in the survey area. The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded from within approximately 4 km of the survey area (considered as 'nearby') taking locational accuracy into account
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection.

The likelihood rating is assigned using the categories listed in **Table 5** and the likelihood assessment is available in **Table 25** in **Appendix Three**. No flora were identified as having been recorded previously. One P1 and three P2 were identified as having a Possible likelihood of occurring based on the information available during the desktop assessment. These were considered the most likely to occur and were prioritised for field survey.

Following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.2**.

**Table 5: Categories for likelihood of occurrence of TF and PF**

| Likelihood      | Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recorded        | Species recorded within the survey area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Possible        | May occur within the survey area (but has not been recorded); broadly, 2-4 of the required attributes (but always including records from nearby) are present in the survey area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Unlikely        | <p>Could occur but is not expected; 1-3 of the required attributes are present in the survey area but:</p> <ul style="list-style-type: none"> <li>• it is not known from nearby, or</li> <li>• it is known from nearby but has no other required attributes, or</li> <li>• it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area), or</li> <li>• it is known from nearby but: <ul style="list-style-type: none"> <li>o the record is old (&gt;25 years), or</li> <li>o the locational data is highly likely to be inaccurate, or</li> <li>o the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area.</li> </ul> </li> </ul> |
| Highly unlikely | The species characteristics include only one or none of the required attributes of soil, landform, associated vegetation and having previously been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 2.2.6 THREATENED AND PRIORITY FAUNA

Exclusively marine species (e.g. whales, sea turtles etc.) and invertebrates are not included in the Threatened and Priority Fauna lists as there is no marine habitat within with the survey area and this is a terrestrial vertebrate survey.

### 2.2.6.1 NatureMap

*NatureMap* (DBCA 2007-2020) is maintained collaboratively by the DBCA and the WAM. These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database maintained by the DBCA.

The *NatureMap* search identified 100 fauna species previously recorded within the applied 4 km buffer area:

- seven mammals (four native; three introduced)
- 69 birds (66 native; three introduced)
- 21 reptiles
- three amphibians.

Of these, four (two mammals and two birds) are conservation-listed:

- *Isodon fusciventer* (Quenda) – P4
- *Notamacropus irma* (Western Brush Wallaby) – P4
- *Calyptorhynchus latirostris* (Carnaby's Cockatoo) – EN EPBC Act, EN BC Act
- *Falco peregrinus* (Peregrine Falcon) – OS BC Act.

*NatureMap* results are incorporated into **Table 26** in **Appendix Three**.

### 2.2.6.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: Payne6384), reduced to a 4 km buffer around the survey area. Five conservation-listed vertebrate fauna were identified as having previously been recorded from within the search area buffer, consisting of:

- two mammals
- three birds.

The results incorporate the conservation-listed species identified from the *NatureMap* search (as above), with one additional species, *Neelaps calonotos* (Black-striped Snake, P3).

DBCA database search results are incorporated into **Table 26** in **Appendix Three** and shown on Map 4.

### 2.2.6.3 Protected Matters Search

The PMST search (Australian Government & DAWE 2020; search reference REUQ47), identified:

- one mammal: 'species or species habitat likely to occur within area'
- 27 birds: 13 'species or species habitat known to occur within area', five 'species or species habitat likely to occur within area', nine 'species or species habitat may occur within area'.

The PMST results are incorporated into **Table 26** in **Appendix Three**. Not all species identified by the PMST search have DBCA/Western Australian Museum (WAM) records (*NatureMap* and DBCA database searches).

### 2.2.6.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of occurrence of significant fauna species identified by the database and literature searches was assessed using the following criteria:

- suitability of habitat types present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 6**.



**Table 6: Categories for likelihood of occurrence of conservation-listed fauna**

| Likelihood | Category                                                                                                                                                                                                                                  |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recorded   | Species recorded within the survey area within a reasonable timeframe (0-25 years)                                                                                                                                                        |
| High       | Species recorded in close proximity to the survey area (<1 km) within the past 25 years; and suitable habitat occurs within the survey area                                                                                               |
| Medium     | Species historically recorded in close proximity (<2 km) to the survey area, more than 25 years ago; and suitable habitat may exist within the survey area                                                                                |
| Low        | Species not recorded in the proximity of the survey area or rarely recorded within 4 km of the survey area; and suitable habitat unlikely to occur within the survey area                                                                 |
| Very Low   | Species not recorded by multiple surveys/databases within 4 km of the survey area and suitable habitat does not occur within the survey area, however, species or suitable habitat is listed as potentially occurring in the wider region |

The likelihood of species occurring within the survey area are indicated in **Table 26** in **Appendix Three**. Five species were assessed as having a High likelihood of occurring within the survey area:

- *Calyptorhynchus latirostris* (Carnaby's Cockatoo)
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)
- *Isoodon fusciventer* (Quenda)
- *Notamacropus irma* (Western Brush Wallaby).

Following the field survey when actual survey area characteristics are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in Sections **4.5.3** and **5.3.3.1**.

## 2.3 LITERATURE REVIEW

One survey is known to have been previously conducted partly within the survey area (in the southwest corner):

- *Targeted Flora and Fauna Assessment – Lot 4 Flynn Drive Neerabup* (Eco Logical Australia Pty Ltd 2013a). The survey included a targeted flora and vegetation community assessment, and an ecological assessment for Carnaby's Black Cockatoo. The report also presents the results of other flora and fauna surveys conducted previously within the area, including the portion intersecting the survey area in the southwest. Of particular significance are the results of the ATA Environmental survey conducted in 2007 which provides vegetation types for comparison in this survey.

The following documents were identified as having relevance to the survey area:

- *Flynn Drive Biological Survey* (Ecoscape 2020a)
- *Conservation Area Management Plan - Mather Reserve (53163) and Lot 24 Mart Street, Wanneroo* (City of Wanneroo 2020)
- *Flynn Drive and Mather Drive Industrial Development, Neerabup – Environmental Review* (Eco Logical Australia Pty Ltd 2013b)
- *Ground Truthing of Environmental Values for Lot 4 Flynn Drive, Neerabup* (Eco Logical Australia Pty Ltd 2012)
- *Spring Flora and Vegetation Survey - Flynn Drive Re-alignment, Neerabup* (Coffey Environments 2008)
- *Vegetation Assessment, Mather Reserve Neerabup and Lot 24 Mary Street Wanneroo* (Ecoscape 2020b)
- *Black Cockatoo Habitat Survey (Neerabup Industrial Area)* (Ecoscape 2019)
- *Flora, Vegetation and Fauna Survey, IWSS Neerabup GW Expansion* (Ecoscape 2017).

## 3 METHODS

### 3.1 FLORA AND VEGETATION FIELD SURVEY

#### 3.1.1 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016). The EPA considers that a detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys, and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition, and condition.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

#### 3.1.2 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016), conducted as a single phase survey.

Conservation criteria used in this assessment are included in **Table 16**, **Table 17** and **Table 18** in **Appendix One**.

Survey method details are outlined below.

##### 3.1.2.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values, and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension, as required according to the Flora and Vegetation Technical Guidance (EPA 2016).

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner

- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the detailed survey where there was sufficient extent. All quadrat locations are displayed on **Map 5**.

#### 3.1.2.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Due to the small extent of the survey area (47.30 ha), the entire area was extensively searched.

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date, and time
- reproductive status and other features such as health of plants, percentage flowering and fruiting
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

#### 3.1.2.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

#### 3.1.2.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 19** and **Table 20** in **Appendix One**). Up to three species per stratum from each stratum (upper, mid, and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first series of letter codes referring to the component species (upper case first letter referring to the genus, lower case one or two letters referring to the species), with the upper case letters at the end referring to the stratum structure e.g. **BiMW** refers to *Banksia ilicifolia* mid woodland.

### 3.1.2.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Keighery vegetation condition scale (Keighery 1994) (

**Table 21 in Appendix One**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

### 3.1.2.6 Field Survey Timing

The field survey was conducted during 29-30 October 2020 which is within the optimal period for a primary survey within the bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016).

## 3.1.3 STATISTICAL ANALYSIS

### 3.1.3.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey effort and habitat known to occur in the survey area.

### 3.1.3.2 Floristic Analysis

PATN© software (Belbin & Collins 2006) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

For this project, a variety of analyses were run. The most informative analysis used the Bray Curtis similarity coefficient for rows (species) and columns (sites) as this provides a good estimation of association for ecological applications (Belbin & Collins 2006). For this analysis we used presence/absence values for each species.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

### 3.1.3.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

## 3.2 FAUNA FIELD SURVEY

### 3.2.1 GUIDING PRINCIPLES

The fauna and fauna habitat survey was conducted as a basic survey according to the Fauna Technical Guidance (EPA 2020a). The EPA recommends a basic survey should:

- be conducted as a low intensity survey to gather broad fauna and habitat information
- verify the adequacy of the desktop assessment
- map, describe and photograph habitats
- record opportunistic fauna observations
- identify possible future survey site locations, access, and logistics
- determine if a detailed survey is required.

Targeted surveys were also conducted to gather information on significant fauna and/or habitats.

### 3.2.2 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020a), conducted as a basic survey.

Conservation criteria used in this assessment are included in **Table 16** and **Table 17** in **Appendix One**.

Survey method details are outlined below.

#### 3.2.2.1 Vertebrate Fauna Survey

The basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020a) including habitat assessment, active searches (day time), raking of spoil heaps and leaf litter, searches for secondary evidence such as scats and tracks, as well as opportunistic searches.

Terrestrial vertebrate fauna were the main targets of the field survey. Survey techniques included:

- opportunistic bird observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath
- raking of litter beds to locate fossorial reptile species
- tree hollow inspection to detect arboreal fauna.

Fauna species were identified opportunistically based on sightings, calls, remains, diggings, and other signs. Potential habitats for conservation significant species were identified and evaluated and their likelihood of occurrence assessed.

Based on the desktop assessment, the following were considered to have a High likelihood of occurring in the survey area and they, and habitat suitable to support them, were targeted during the field survey:

- Carnaby's Cockatoo
- Forest Red-tailed Black Cockatoo
- Quenda
- Western Brush Wallaby.

### 3.2.2.2 Fauna Habitat Assessment

The fauna habitats present within the survey area were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristics
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

### 3.2.2.3 Targeted Survey Methods

#### Black Cockatoo Assessment (Carnaby's Cockatoo; Baudin's Cockatoo, Forest Red-tailed Black-cockatoo)

Potential and active (actual) Black Cockatoo breeding trees were assessed as per Commonwealth guidance (DSEWPaC 2012). Relevant aspects of the recent draft referral guidelines (Commonwealth of Australia 2017) were also incorporated into the survey as this allows data to be gathered that could potentially be used when the updated referral guidelines are finalised.

Potential and actual Black Cockatoo habitat trees are:

- listed tree species as provided in the Commonwealth guidance (DSEWPaC 2012)
- minimum size of 500 mm diameter at breast height (DBH) for most species, or 300 mm DBH for Salmon Gum and Wandoo.

The following were recorded for each potential and actual habitat tree:

- location, recorded using a handheld GPS device with an accuracy of approximately 5 m
- species and DBH
- identifying if tree hollows of suitable size [and orientation] are present, and recording evidence of use by cockatoos such as chewing at the hollow entrance
- habitat value according to the scoring system developed by Dr Mike Bamford (2016); this score reflects the existing value of the tree characteristics with respect to its potential to be used as a nesting tree (as per **Table 22 in Appendix One**)
- photograph of each tree, showing hollows, if possible
- known nesting trees as per DBCA data.

The suitability of the survey area for breeding (additional to the specific tree survey) and as foraging habitat (as per the Commonwealth (2017) scoring tool; **Table 23** in **Appendix One**) was also assessed and mapped, taking into consideration:

- the presence of species favoured for foraging (as listed in the Commonwealth guidance, including Proteaceous species, Eucalypt species, *Pinus* species etc.)
- evidence of foraging e.g. chewed Eucalypt nuts
- location of known nesting or night roosting trees
- surrounding vegetation, up to at least 12 km from the survey area and taking into consideration the proximity to any known breeding habitat and watering points
- presence of disease, such as *Phytophthora cinnamomi* or Marri Canker (*Quambalaria coyrecup*).

#### 3.2.2.4 Field Survey Timing

The survey was conducted over one day during October 2020. October is within the optimal timing for fauna survey for the majority of fauna groups likely to inhabit the survey area (EPA 2020a).

#### 3.2.2.5 Data Management

Data gathered through the desktop review, field survey habitat assessments and observations will be collated to provide locations of significant fauna species records and maps of fauna habitat types. Fauna habitat quality is assessed at each sampling point to provide an overall habitat quality of the survey area as this may vary across habitats of different type.



## 4 FIELD SURVEY RESULTS

### 4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by James Tsakalos (Senior Environmental Scientist, Flora Collecting Permit FB62000163; Threatened Flora Collecting Permit TFL 58-1920) on during 29-30 October 2020.

### 4.2 FLORA

#### 4.2.1 FLORA INVENTORY

A total of 113 vascular flora were recorded from 93 genera and 39 families from 15 floristic quadrats, opportunistic observations, and searches for conservation-listed flora. Of these, 26 were introduced (23.01%) and three (2.30%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Poaceae (13 taxa, nine introduced), Myrtaceae (12) and Fabaceae (11). The most commonly represented genera were *Stylidium* with five taxa, *Eucalyptus* (three) and *Banksia* (three).

The number of species per quadrat ranged from 50 in quadrat NQ01 to eight in quadrat NQ14, with an average species diversity per quadrat of 20.87. The most commonly recorded species were *\*Ehrharta calycina* recorded from 13 quadrats, *\*Gladiolus caryophyllaceus* (10 quadrats), *\*Ursinia anthemoides* subsp. *anthemoides* and *\*Briza maxima* (nine quadrats each).

The combined flora inventory is presented in **Table 27** in **Appendix Four**. Quadrat data is presented in **Appendix Five**.

#### 4.2.2 CONSERVATION-LISTED FLORA

##### Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed Threatened Flora were recorded during the field survey.

##### Priority Flora

No Priority-listed flora were recorded during the field survey.

#### 4.2.3 OTHER SIGNIFICANT FLORA

No flora taxa having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

#### 4.2.4 FLORA OF TAXONOMIC INTEREST

No flora of taxonomic interest were recorded during the field survey.

#### 4.2.5 INTRODUCED FLORA

Twenty six introduced flora species (weeds) were recorded during the field survey, representing 23.01% of the overall flora inventory. *\*Ehrharta calycina* (Perennial Veldt Grass) was the most commonly recorded introduced species occurring in 13 of 15 quadrats and was a major contributor to vegetation condition assessment.

Of the introduced flora, two species have significance:

- \**Asparagus asparagoides* - WoNS and Declared Pest
- \**Moraea miniata* - Declared Pest.

## 4.3 VEGETATION

### 4.3.1 VEGETATION TYPES

Four vegetation types were recorded from within the survey area (**Table 7, Map 5**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.3.4**) and subsequent desktop review.

Table 7: Vegetation types

| Landform  | Mapping unit | Vegetation type                                                                                                                                                                                                                                                         | Floristic quadrats          | Representative photograph                                                           | Other characteristic species                                                                                                                                                             | Area (ha) and extent (%) |
|-----------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Sandplain | <b>BaMW</b>  | <i>Banksia attenuata</i> and <i>B. menziesii</i> mid woodland over <i>Allocasuarina humilis</i> tall sparse shrubland over <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> and * <i>Ehrharta calycina</i> low open shrubland/tussock grassland                 | NQ01<br>NQ02<br><b>NQ03</b> |   | <i>Beaufortia elegans</i> , <i>Gompholobium tomentosum</i> , <i>Xanthorrhoea preissii</i> , <i>Tetraria octandra</i> , <i>Jacksonia sternbergiana</i> , <i>Styphelia conostephioides</i> | 2.65 ha<br>5.60%         |
| Sandplain | <b>BiMW</b>  | <i>Banksia ilicifolia</i> mid woodland over <i>Kunzea glabrescens</i> and <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> tall shrubland over <i>Lyginia imberbis</i> , <i>Brachyloma preissii</i> and <i>Hibbertia racemosa</i> mid open rushland/low open shrubland | <b>NQ04</b><br>NQ05<br>NQ06 |  | <i>Banksia menziesii</i> , <i>Jacksonia furcellata</i>                                                                                                                                   | 1.28 ha<br>2.71%         |

| Landform                        | Mapping unit | Vegetation type                                                                                                                                                                                                                                                      | Floristic quadrats                           | Representative photograph                                                           | Other characteristic species                                                                                                                                                                                            | Area (ha) and extent (%) |
|---------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Sandplain                       | EtLMW        | <i>Eucalyptus tottiana</i> and <i>Nuytsia floribunda</i> mid mallee woodland/low woodland over <i>Ehrharta calycina</i> mid open tussock grassland                                                                                                                   | NQ09<br>NQ10<br>NQ11                         |   | <i>Jacksonia sternbergiana</i> , <i>Stirlingia latifolia</i> , <i>Aira caryophyllea</i> , <i>Eremaea pauciflora</i> , <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>                                          | 12.88 ha<br>27.23%       |
| Sandplain                       | MpMW         | <i>Melaleuca preissiana</i> and <i>Eucalyptus rudis</i> subsp. <i>rudis</i> mid woodland over <i>Ehrharta calycina</i> , <i>Carpobrotus edulis</i> and <i>Bromus diandrus</i> mid open tussock grassland/forbland with <i>Astartea scoparia</i> tall isolated shrubs | NQ07<br>NQ08<br>NQ12<br>NQ13<br>NQ14<br>NQ15 |  | <i>Nuytsia floribunda</i> , <i>Dianella revoluta</i> var. <i>divaricata</i> , <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> , <i>Corynotheca micrantha</i> , <i>Aira caryophyllea</i> , <i>Jacksonia furcellata</i> | 19.67 ha<br>41.60%       |
| Not native vegetation (cleared) |              |                                                                                                                                                                                                                                                                      |                                              |                                                                                     |                                                                                                                                                                                                                         | 10.81 ha 22.86%          |
| <b>TOTAL EXTENT</b>             |              |                                                                                                                                                                                                                                                                      |                                              |                                                                                     |                                                                                                                                                                                                                         | <b>47.30 ha 100%</b>     |

### 4.3.2 VEGETATION SIGNIFICANCE

#### TECs and PECs

Database searches (**Section 2.2.4**) identified the *Banksia Woodlands on the Swan Coastal Plain* PEC/TEC as occurring within the survey area. Two vegetation types observed during the field survey (**BaMW** and **BiMW**) are consistent with the criteria defined for this TEC (shown on **Map 5**), specifically:

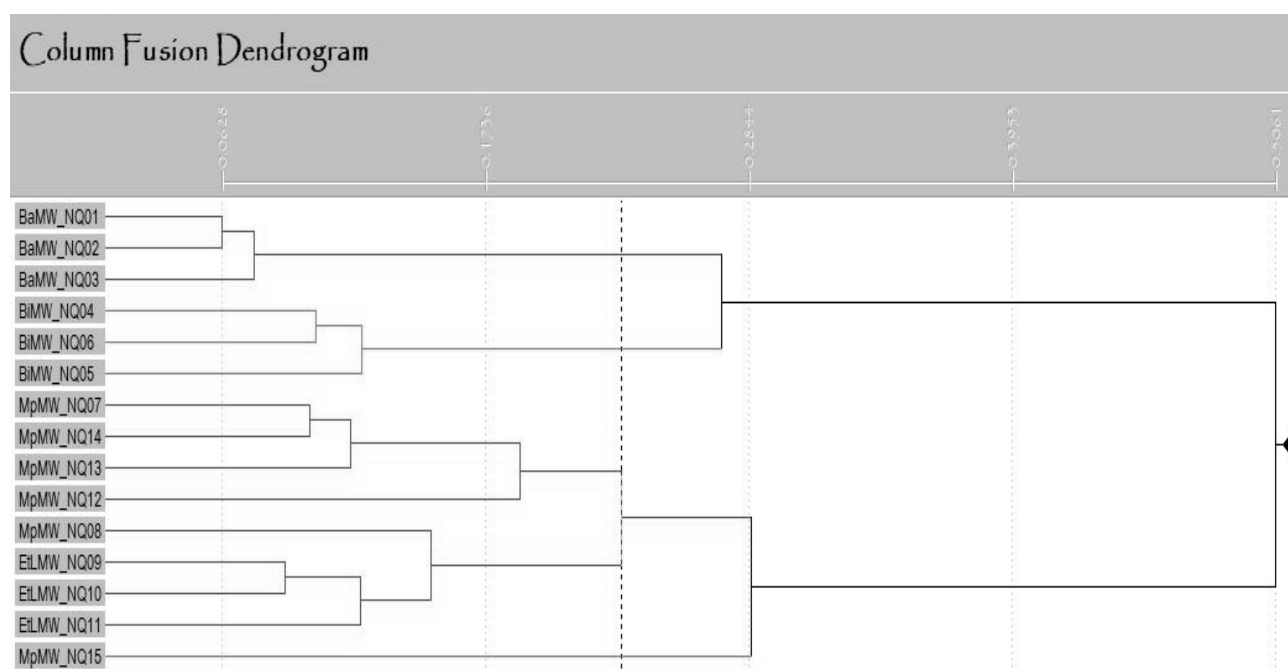
- a distinct upper stratum of trees dominated by *Banksia attenuata*, *B. menziesii* and *B. ilicifolia*
- vegetation assessed in Good to Very Good condition and greater than 1 hectare patch size (also taking into consideration the extrapolation of vegetation within the same patch outside the survey area)
- species-rich understorey with key species present (*Adenanthos cygnorum* subsp. *cygnorum*, *Allocasuarina humilis*, *Gompholobium tomentosum*, *Hibbertia hypericoides* subsp. *hypericoides*, *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Lyginia imberbis*, *Jacksonia furcellata*).

### 4.3.3 OTHER SIGNIFICANT VEGETATION

No vegetation having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) was recorded during the field survey.

### 4.3.4 FLORISTIC ANALYSIS

The floristic analysis dendrogram (**Figure 3**) indicates four distinct floristic groups based on the quadrats recorded. The grouping of quadrats mostly aligns with the vegetation units observed in the field. The Very Good condition quadrats within vegetation types **BaMW** and **BiMW** in the northern end of the survey area formed the most discrete groupings and these quadrats were also located adjacent to areas of native vegetation. Vegetation type **MpMW** is less clearly defined floristically (likely due to Degraded condition) and was defined based on on-ground interpretation using species dominance and vegetation structure.



**Figure 3: Floristic analysis dendrogram**



### 4.3.5 VEGETATION CONDITION

The vegetation condition within the survey area ranged from Degraded to Very Good condition, with the majority in Degraded condition (**Table 8, Map 6**). The main factor affecting vegetation condition was disturbance from weeds and vehicles as evidenced by the number of vehicle tracks observed within the survey area.

**Table 8: Vegetation condition**

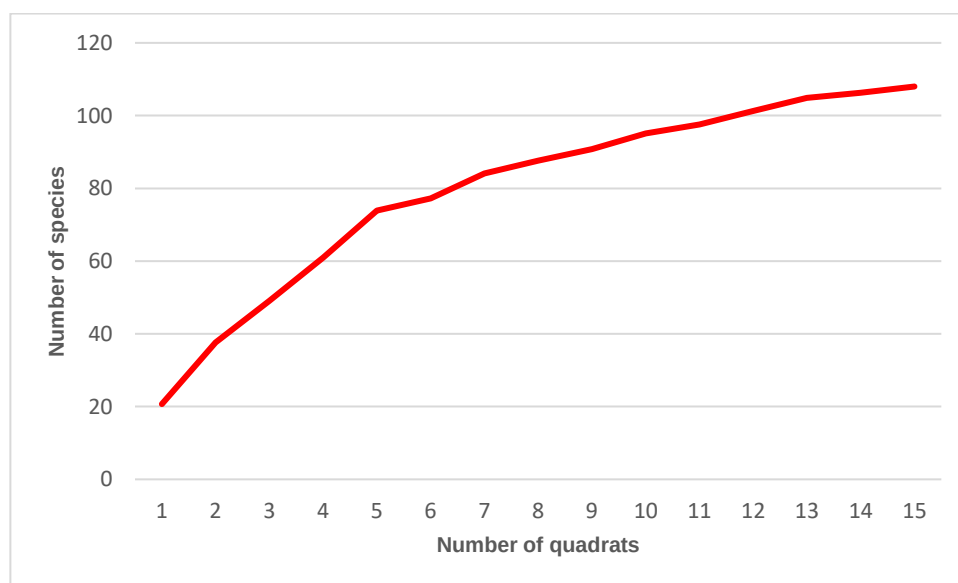
| Vegetation condition  | Extent (ha) | Proportion (%) |
|-----------------------|-------------|----------------|
| Pristine              | 0           | 0              |
| Excellent             | 0           | 0              |
| Very Good             | 2.11        | 4.45           |
| Good                  | 0.66        | 1.39           |
| Degraded              | 33.72       | 71.30          |
| Completely Degraded   | 0           | 0              |
| Cleared/Not vegetated | 10.81       | 22.86          |

### 4.3.6 ADEQUACY OF SURVEY

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (**Figure 4**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that the majority of species present within the survey area have been recorded. The Bootstrap estimate of species richness is 123.9 which, when taking opportunistic records into account, is slightly higher than the 113 species recorded during the survey. This indicates that 91.20% of the flora taxa have likely been recorded.



**Figure 4: Species accumulation curve**

## 4.4 BOTANICAL LIMITATIONS

**Survey design:** Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation-listed flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

**Survey type:** Detailed flora and vegetation survey with extensive searches for significant flora searches conducted over a single phase. All areas were adequately surveyed through the use of floristic quadrats to sample vegetation types, and targeted searches for conservation significant flora.

**Type of vegetation classification system:** Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

Survey timing was optimal for the bioregion, however, rainfall in the six months prior to the survey was 65% of the mean rainfall for that same period. The lower-than-average rainfall may be a constraint for the number of annual and ephemeral species recorded.

A full summary of botanical limitations is presented in **Table 9**.

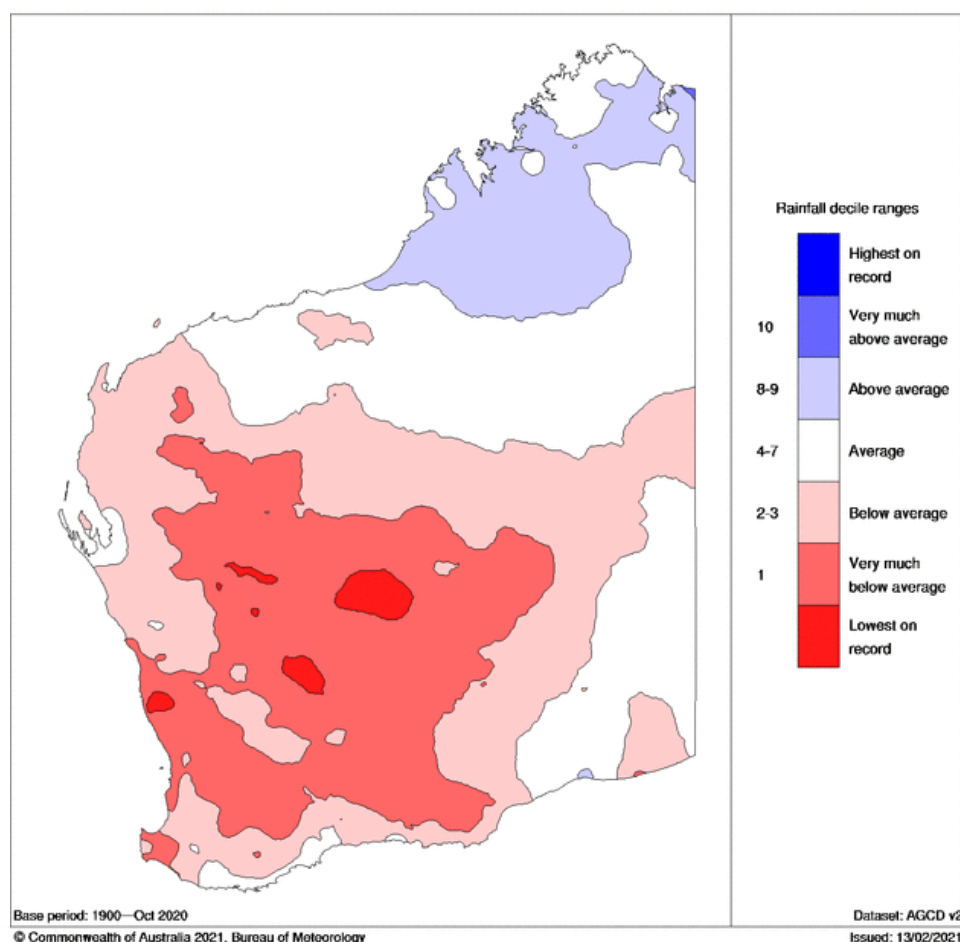
**Table 9: Botanical limitations**

| Possible limitations                                                                                    | Constraints (yes/no):<br>Significant,<br>moderate, or<br>negligible | Comment                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Availability of contextual information at a regional and local scale                                    | No                                                                  | One survey was previously conducted partially within the survey area and several surveys have been conducted in the general vicinity, as identified in Section 2.3. The vegetation of the Swan Coastal Plain is well studied.                                                                                                                                                    |
| Competence/experience of the team conducting the survey, including experience in the bioregion surveyed | No                                                                  | The botanist conducting the field survey has six years of experience flora and vegetation surveys throughout Western Australia, including the Swan Coastal Plain.                                                                                                                                                                                                                |
| Proportion of the flora recorded and/or collected, and any identification issues                        | Negligible                                                          | 113 vascular flora taxa were recorded during the field survey of which 2.30% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered a relatively low level of unidentified taxa.<br><br>None of the unidentified taxa are considered likely to represent any conservation-listed flora from the region. |
| Was the appropriate area fully surveyed (effort and extent)                                             | No                                                                  | The survey area was covered sufficiently to develop a thorough understanding of the flora and vegetation.                                                                                                                                                                                                                                                                        |
| Access restrictions within the survey area                                                              | No                                                                  | The entire survey area was easily accessible on foot.                                                                                                                                                                                                                                                                                                                            |
| Survey timing, rainfall, season of survey                                                               | Moderate                                                            | The field survey was conducted during October which coincides with the optimal period for botanical survey in the bioregion. However, the rainfall in the six months prior to the survey was 65% of the average rainfall for that same period (see <b>Figure 5</b> ). This may represent a                                                                                       |

| Possible limitations                                                                    | Constraints (yes/no):<br>Significant,<br>moderate, or<br>negligible | Comment                                                                                                                                   |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                         |                                                                     | moderate constraint for the number of annual and ephemeral species recorded.                                                              |
| Disturbance that may have affected the results of the survey e.g. fire, flood, clearing | No                                                                  | There were no recent disturbances that would have affected the results of the survey.<br>None of the survey area had been recently burnt. |

Western Australian rainfall deciles 1 May to 31 October 2020

Australian Gridded Climate Data



**Figure 5: Rainfall deciles for the six months prior to the field survey**

## 4.5 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Hugh Osborn (Zoologist) during 29 October 2020. The survey was conducted in accordance with the requirements outlined in the Fauna Technical Guidance (EPA 2020a).

The entire site was traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species.



#### 4.5.1 FAUNA ASSEMBLAGE

A total of 18 vertebrate fauna species were recorded during the survey (**Table 10**), consisting of:

- three mammals (two introduced)
- 14 birds (one introduced)
- one reptile.

Survey sites are listed in **Table 28** in **Appendix Four**.

**Table 10: Recorded fauna species**

| Species                              | Common name               | EPBC Act status | Western Australian status |
|--------------------------------------|---------------------------|-----------------|---------------------------|
| <b>Mammals</b>                       |                           |                 |                           |
| <i>*Canis familiaris familiaris</i>  | Dog                       | -               | -                         |
| <i>*Oryctolagus cuniculus</i>        | Rabbit                    | -               | -                         |
| <i>Macropus fuliginosus melanops</i> | Western Grey Kangaroo     | -               | -                         |
| <b>Birds</b>                         |                           |                 |                           |
| <i>*Dacelo novaeguineae</i>          | Laughing Kookaburra       | -               | -                         |
| <i>Todiramphus sanctus</i>           | Sacred Kingfisher         | -               | -                         |
| <i>Cacatua roseicapilla</i>          | Galah                     | -               | -                         |
| <i>Coracina novaehollandiae</i>      | Black-faced Cuckoo-shrike | -               | -                         |
| <i>Cracticus tibicen</i>             | Australian Magpie         | -               | -                         |
| <i>Falco berigora</i>                | Brown Falcon              | -               | -                         |
| <i>Lichmera indistincta</i>          | Brown Honeyeater          | -               | -                         |
| <i>Phylidonyris novaehollandiae</i>  | New Holland Honeyeater    | -               | -                         |
| <i>Merops ornatus</i>                | Rainbow Bee-eater         | MA              |                           |
| <i>Petroica goodenovii</i>           | Red-capped Robin          | -               | -                         |
| <i>Platycercus spurius</i>           | Red-capped Parrot         | -               | -                         |
| <i>Platycercus zonarius</i>          | Australian Ringneck       | -               | -                         |
| <i>Rhipidura leucophrys</i>          | Willie Wagtail            | -               | -                         |
| <i>Threskiornis spinicollis</i>      | Straw-necked Ibis         | -               | -                         |
| <b>Reptiles</b>                      |                           |                 |                           |
| <i>Ctenophorus adalaidensis</i>      | Western Heath Dragon      | -               | -                         |

\* denotes introduced species

#### 4.5.2 FAUNA HABITAT

Two fauna habitat types were recorded within the survey area (**Table 11**):

- *Banksia* Woodland
- Degraded Woodland (*Eucalyptus todtiana*, *Melaleuca preissiana*, *Eucalyptus rudis*).

Table 11: Fauna habitat types

| Habitat type                                                                                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Photograph                                                                          |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b><i>Banksia</i> Woodland</b>                                                                              | <p><b>Description:</b> <i>Banksia</i> dominated woodland over mixed shrubs</p> <p>Habitat is suitable for expected suite of small reptiles, mammals, and woodland birds. Breeding, foraging and roosting habitat for Black Cockatoo species.</p> <p><b>Extent:</b> 3.66 ha; 7.74%</p>                                                                                                                                                                          |   |
| <b>Degraded Woodland (<i>Eucalyptus todtiana</i>, <i>Melaleuca preissiana</i>, <i>Eucalyptus rudis</i>)</b> | <p><b>Description:</b> Degraded open woodland of Paperbark (<i>Melaleuca preissiana</i>), Flooded Gum (<i>Eucalyptus rudis</i>) and Coastal Blackbutt (<i>Eucalyptus todtiana</i>) over scattered shrubs and grasses on white sand, with patches of sedgeland on seasonally wet soil.</p> <p>Habitat is suitable for Woodland Birds, Western Grey Kangaroo and Rabbit. Foraging habitat for Black Cockatoo species.</p> <p><b>Extent:</b> 32.55 ha; 68.82%</p> |  |
| <b>No habitat</b>                                                                                           | <p><b>Description:</b> Cleared areas containing little to no native vegetation</p> <p>This habitat is unsuitable to support fauna species.</p> <p><b>Extent:</b> 11.08 ha; 23.43%</p>                                                                                                                                                                                                                                                                          |                                                                                     |

The survey area is separated by a well-maintained fence line running east to west through the entire northern portion of the area which also encloses this portion. This fence line effectively divides the area into two parts, likely preventing larger ground-dwelling animals from passing through. On the north of this divide are the areas of *Banksia* Woodland fauna habitat and in the south are the areas of Degraded Woodland.

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape. Twelve habitat assessment sampling points were recorded to represent the habitat types present, recording the values of habitat characteristics that currently

exist within the survey area (**Table 28** in **Appendix Four**). Images representing each sampling point are displayed in **Table 29** in **Appendix Four**.

### 4.5.3 SIGNIFICANT FAUNA AND ASSOCIATED HABITAT

The significant fauna species observed during the field survey are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort.

#### 4.5.3.1 Rainbow Bee-eater (*Merops ornatus*) – MA EPBC status

The Rainbow Bee-eater is listed as Marine and protected under the EPBC Act. It inhabits a range of habitats including most vegetation types, open country, sand dunes and banks (Simpson & Day 2004). The species was seen utilising trees within the Degraded Woodland fauna habitat to perch and hunt.

The habitat within the survey area may be used by this species for foraging as part of the greater surrounds. The species has a broad habitat suitability and therefore the survey area is unlikely to be significant habitat for this species.

### 4.5.4 BLACK COCKATOO BREEDING HABITAT

Trees suitable or potentially suitable to be used for breeding by Black Cockatoos were surveyed throughout the survey area. A list of trees is provided in (**Table 31**). Each tree was assessed for the potential to provide breeding habitat for the Black Cockatoo species (Forest Red-tailed Black Cockatoo, Baudin's Cockatoo and Carnaby's Cockatoo) as per Commonwealth guidelines (DSEWPac 2012).

A total of 19 trees were recorded as having potential to be used for breeding by Black Cockatoos, consisting of three Jarrah (*Eucalyptus marginata*) and 16 Flooded Gum (*Eucalyptus rudis*) (**Table 30**). The recorded trees were all scored using the scale developed by Dr Mike Bamford (Bamford 2016) () to further refine nesting value to the Black Cockatoo species and the results summarised in **Table 12**.

**Table 12: Potential breeding tree species by class**

| Tree species                            | Class 4  | Class 5   | Species total |
|-----------------------------------------|----------|-----------|---------------|
| Jarrah ( <i>Eucalyptus marginata</i> )  | 1        | 2         | 3             |
| Flooded Gum ( <i>Eucalyptus rudis</i> ) | 2        | 14        | 16            |
| <b>Total</b>                            | <b>3</b> | <b>16</b> | <b>19</b>     |

No trees were recorded of Class 3 or above. A total of three trees of Class 4 and 16 trees of Class 5 were recorded. These trees do not currently exhibit the characteristics necessary for Black Cockatoo use for nesting. Due to the trees being of a suitable size (DBH > 500mm) to potentially provide suitable nesting hollows in the future, they have been recorded (DSEWPac 2012).

The survey area is unlikely to currently provide breeding habitat for Black Cockatoo species as it does not contain suitable sized hollows for Black Cockatoo nesting (Class 3 trees and above).

### 4.5.5 BLACK COCKATOO FORAGING HABITAT

Based on the Revised Draft Referral Guidelines for the three Black Cockatoo species (Commonwealth of Australia 2017), the survey area was assessed for quality of existing suitable foraging habitat (**Table 23**). The survey area contains *Banksia* Woodland fauna habitat, containing a diversity of species including proteaceous shrubs and trees, which is foraging habitat for all three Black Cockatoo species. The Degraded Woodland contains large trees such as Coastal Blackbutt (*Eucalyptus tottiana*) and Flooded Gum (*Eucalyptus rudis*) which

may be utilised as roost sites by Black Cockatoo and as foraging resources, along with scattered proteaceous shrubs. No evidence of Black Cockatoo presence was found during the survey.

The habitat quality scores as below were tabulated using the guidelines' example. Foraging habitat quality for Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo were assessed and scored as detailed in **Table 13** and **Table 14**. The modelled distribution for Baudin's Cockatoo does not extend to the survey area and this species is not likely to occur, therefore, a scoring assessment has not been included.

**Table 13: Foraging habitat scoring tool – Carnaby's Cockatoo**

| Habitat Summary for Carnaby's Cockatoo Foraging Habitat                                                   |  | Score     |
|-----------------------------------------------------------------------------------------------------------|--|-----------|
| <b>Starting Score:</b>                                                                                    |  |           |
| Survey area has a section of <i>Banksia</i> Woodland i.e. Woodland dominated by proteaceous plant species |  | +7        |
| <b>Attributes improving functionality of foraging habitat:</b>                                            |  |           |
| Impact area is within the Swan Coastal Plain (important foraging habitat)                                 |  | +3        |
| Impact area contains trees with potential to be used for breeding (DBH ≥500 mm)                           |  | +2        |
| <b>Attributes reducing functionality of foraging habitat:</b>                                             |  |           |
| No clear evidence of feeding debris                                                                       |  | -2        |
| <b>FINAL SCORE</b>                                                                                        |  | <b>10</b> |

The final score is **10** (of a maximum score of 21). According to the guidelines (Commonwealth of Australia 2017) this indicates **very high quality** foraging habitat for Carnaby's Cockatoo.

**Table 14: Foraging habitat scoring tool – Forest Red-tailed Black Cockatoo**

| Habitat Summary for Forest Red-tailed Black Cockatoo Foraging Habitat                            |  | Score    |
|--------------------------------------------------------------------------------------------------|--|----------|
| <b>Starting Score:</b>                                                                           |  |          |
| Survey area contains some Jarrah and <i>Allocasuarina</i> cones which provide foraging resources |  | +7       |
| <b>Attributes improving functionality of foraging habitat:</b>                                   |  |          |
| Impact area contains trees with potential to be used for breeding (DBH ≥500 mm)                  |  | +2       |
| <b>Attributes reducing functionality of foraging habitat:</b>                                    |  |          |
| No clear evidence of feeding debris                                                              |  | -2       |
| <b>FINAL SCORE</b>                                                                               |  | <b>7</b> |

The final score is **7** (out of a maximum score of 21). According to the guidelines this indicates **high quality** foraging habitat for Forest Red-tailed Black Cockatoo.

## 4.6 FAUNA SURVEY LIMITATIONS

The limitations of the basic fauna survey are summarised in **Table 15** below. There were no constraints in relation to survey adequacy.

**Table 15: Fauna survey limitations**

| Possible limitations                                                                                                                              | Constraints (yes/no): Significant, moderate, or negligible | Comment                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Competency/experience of the consultant conducting the survey                                                                                     | No                                                         | The fauna field surveyor was experienced with the fauna survey methods used and with the identification of fauna taxa.                                                                                                                                                                  |
| Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions). | No                                                         | The survey was conducted as a Basic fauna assessment. Sufficient time was allocated to the fauna survey, which included active diurnal searches to adequately describe the fauna assemblage present in the survey area.                                                                 |
| Proportion of fauna identified, recorded and/or collected.                                                                                        | No                                                         | All fauna species opportunistically observed were identified in the field.                                                                                                                                                                                                              |
| Sources of information (previously available information as distinct from new data).                                                              | No                                                         | Many sources referencing field surveys in the vicinity were available. No constraints were associated with this previous data.                                                                                                                                                          |
| The proportion of the task achieved and further work which might be needed.                                                                       | No                                                         | The survey area was adequately searched.                                                                                                                                                                                                                                                |
| Timing/weather/season/cycle.                                                                                                                      | No                                                         | The timing of the field survey was within a period suitable to identify most components of the expected fauna assemblage if they were present on site. The seasonal conditions were suitable for fauna survey with warm daytime temperatures and fine weather during the survey period. |
| Disturbances which affected results of the survey (e.g., fire, flood, accidental human intervention).                                             | No                                                         | No disturbance to the survey was detected.                                                                                                                                                                                                                                              |
| Intensity (in retrospect was the intensity adequate).                                                                                             | No                                                         | The survey was considered suitable to determine the presence or potential presence of conservation significant fauna.                                                                                                                                                                   |
| Completeness (e.g., was relevant area fully surveyed), remoteness and/or access problems                                                          | No                                                         | The entire survey area was adequately searched and was entirely accessible.                                                                                                                                                                                                             |
| Resources (e.g., degree of expertise available in animal identification to taxon level).                                                          | No                                                         | Field staff has over 10 years' experience identifying fauna. All terrestrial vertebrate fauna was identified to species level.                                                                                                                                                          |
| Availability of contextual (e.g., biogeographic) information on the region).                                                                      | Negligible                                                 | Few fauna surveys appear to have been conducted in the general region. However, there is 1990s literature available describing the suite of species present at that time, giving context to the discussion in this report.                                                              |
| Efficacy of sampling methods (i.e., any groups not sampled by survey methods).                                                                    | No                                                         | The survey was conducted as a Basic fauna assessment. All fauna species opportunistically observed were identified in the field. The survey did not include marine, subterranean, nor invertebrate species.                                                                             |

## 5 DISCUSSION

### 5.1 FLORA SIGNIFICANCE

Ecoscape recorded a total of 113 vascular flora from within the survey area including three that could not be identified with certainty due to insufficient diagnostic reproductive material. The species accumulation curve generated using quadrat data indicates that additional taxa would have been recorded with additional survey effort. However, the Bootstrap estimate of species richness shows that 91.20% of the flora taxa have been recorded which represents most species likely present. Ecoscape considers that if seasonal conditions were optimal with average or above-average rainfall in the months preceding the survey, additional annual and ephemeral species would occur.

#### 5.1.1 LOCAL AND REGIONAL ASSESSMENT OF FLORA SIGNIFICANCE

##### 5.1.1.1 Conservation-listed Flora

###### Threatened and Priority Flora

Three TF and 16 PF were identified in the database searches as occurring within the search area however no TP or PF were recorded from within the survey area. The targeted flora survey conducted by Eco Logical Australia (ELA) (2013a) which partially intersects the survey area in the southwest, also did not record any TF or PF.

##### 5.1.1.2 Post-survey Likelihood Assessment

Four conservation-listed flora were considered as 'Possible' to occur within the survey area based on information available prior to the survey i.e. the desktop assessment. The likelihood of conservation-listed flora occurring in the survey area was revised following the field survey. The likelihood for these four species was revised to 'Unlikely', taking into account vegetation condition, grazing, weeds, other disturbances, actual habitat availability and search effort. There revised likelihood assessment is included in **Table 25** in **Appendix Three**.

##### 5.1.1.3 Other Significant Flora

No flora taxa having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

##### 5.1.1.4 Introduced Flora

Ecoscape recorded 26 introduced flora species (weeds) within the survey area, representing 23.01% of the overall flora inventory. Two of the weed species recorded are significant weeds: *Asparagus asparagoides* is a Weed of National Significance and Declared Pest, and *Moraea miniata* is a Declared Pest. Most of the other weed species are commonly recorded weeds and have no specific significance.

### 5.2 VEGETATION SIGNIFICANCE

Four vegetation types were recorded from within the survey area with the floristic analysis confirming the floristic groups. The vegetation types correspond with one broad landform unit: gently undulating sandplains. The vegetation types recorded were:



- **BaMW:** *Banksia attenuata* and *B. menziesii* mid woodland over *Allocasuarina humilis* tall sparse shrubland over *Hibbertia hypericoides* subsp. *hypericoides* and *\*Ehrharta calycina* low open shrubland/tussock grassland
- **BiMW:** *Banksia ilicifolia* mid woodland over *Kunzea glabrescens* and *Adenanthos cygnorum* subsp. *cygnorum* tall shrubland over *Lyginia imberbis*, *Brachyloma preissii* and *Hibbertia racemosa* mid open rushland/low open shrubland
- **EtLMW:** *Eucalyptus tottiana* and *Nuytsia floribunda* mid mallee woodland/low woodland over *\*Ehrharta calycina* mid open tussock grassland
- **MpMW:** *Melaleuca preissiana* and *Eucalyptus rudis* subsp. *rudis* mid woodland over *\*Ehrharta calycina*, *\*Carpobrotus edulis* and *\*Bromus diandrus* mid open tussock grassland/forbland with *Astartea scoparia* tall isolated shrubs.

Minor differences in vegetation types **EtLMW** and **MpMW** occur between this survey and the survey results of ATA Environmental (cited in Eco Logical Australia (2013a)) which intersects the southwest corner of the survey area. However, this is largely the result of differences in survey design and effort, and naming conventions used to determine vegetation type codes and descriptions.

### 5.2.1 LOCAL AND REGIONAL ASSESSMENT OF VEGETATION SIGNIFICANCE

Vegetation of the **BaMW** and **BiMW** vegetation types in the northern section of the survey area is considered to represent the *Banksia Woodlands on the Swan Coastal Plain* TEC and PEC (**Map 5**). The proportion of vegetation assessed as a TEC/PEC within the vegetation types **BaMW** and **BiMW** is 79.54% and 50.98% respectively. The vegetation was assessed against the criteria detailed in the Approved Conservation Advice for the *Banksia Woodlands on the Swan Coastal Plain* TEC (TSSC 2016) **Appendix Two**.

### 5.2.2 VEGETATION CONDITION

No vegetation was assessed as being in Pristine or Excellent condition. The majority of vegetation to the east and west of the go kart track (corresponding with the *Banksia Woodlands on the Swan Coastal Plain* TEC/PEC and vegetation types **BaMW** and **BiMW**) was assessed as Good to Very Good, representing 5.84% of the survey area. These areas of better vegetation condition were located further from the go kart track and adjacent cleared areas. The area to the south of the go kart track was assessed as mostly Degraded, representing 71.30% of the survey area. Similarly, the vegetation condition mapping by Eco Logical Australia (2013a) for the intersecting area in the southwest recorded the vegetation in mostly Degraded condition with a smaller portion assessed as Good. The minor differences in vegetation condition between this survey and the ELA survey are not considered significant and could be indicative of degradation that has occurred since 2013.

Weed cover and disturbance from vehicles (as evidenced by a number of tracks) were the major factors affecting vegetation condition in the survey area.

## 5.3 FAUNA SIGNIFICANCE

### 5.3.1 FAUNA HABITAT TYPES

Two fauna habitat types were recorded within the survey area: *Banksia* Woodland and Degraded Woodland (*Eucalyptus tottiana*, *Melaleuca preissiana*, *Eucalyptus rudis*). Each of these habitat types supports a common suite of birds, mammals, and reptiles, some of which have specific requirements unique to a particular habitat



such as passerine woodland bird species and small fossorial reptiles. The survey area is divided by a fence line running east to west along the northern portion of the area, separating the areas of *Banksia* Woodland and Degraded Woodland.

The *Banksia* Woodland habitat contains a diversity of trees and shrubs which provide both foraging resources and habitat structure for fauna. This habitat provides refuge areas and resources in the leaf litter and dense shrub understorey for fossorial reptiles, birds, and small mammals such as Quenda. This habitat also provides foraging opportunities for Black Cockatoo species.

The Degraded Woodland fauna habitat is of low value for most fauna species, particularly small ground-dwelling species, but is still of moderate value to bird species. The remnant trees of the Degraded Woodland (2013a) provide habitat structure and foraging opportunities for bird species such as Purple-crowned Lorikeets, Rainbow Bee-eaters, Sacred Kingfishers and Red-capped Robins. This area is also likely to provide foraging resources to Black Cockatoos. The seasonally wet sedgelands provide a water source throughout part of the year. The remnant trees in an otherwise degraded area may still provide nesting and breeding opportunities for suitable bird species. The habitat is also utilised by introduced predators such as Dogs, Foxes and Cats and grazing animals such as Rabbits and Western Grey Kangaroos.

### 5.3.2 FAUNA ASSEMBLAGE

The fauna survey identified an expected suite of species for the existing habitats. The eighteen species detected during the basic survey included a variety of birds, three mammals (including two introduced) and one reptile. Bird species were seen throughout the entire survey area and were diverse in the open areas of the Degraded Woodland.

### 5.3.3 CONSERVATION-LISTED SPECIES

No conservation listed species other than the Rainbow Bee-eater (EPBC-listed as Marine) were recorded during the field survey. A species listed as Marine is protected under the EPBC Act, even if not listed as Threatened (e.g. Endangered, Vulnerable etc.). The *Banksia* Woodland habitat within the survey area is suitable for conservation-listed species Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Quenda.

The two Black Cockatoo species are known to utilise the woodland habitats for foraging and roosting with the potential for use as breeding habitat (Ecoscape 2019). The Quenda and Western Brush Wallaby are common residents making use of large extents of bushland and connections to nearby wetlands.

#### 5.3.3.1 Post-survey Likelihood Assessment

The remaining conservation-listed fauna species identified during the desktop assessment as having a High likelihood of occurring are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort. The post-survey likelihood assessment is incorporated into **Table 26** in **Appendix Three**.

#### Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – EN EPBC status; EN BC status/DBCA status

Carnaby's Cockatoo is a large species of cockatoo endemic to south-western Western Australia which has predominantly black plumage with white cheek patches and tail feather panels. The known distribution for the species runs roughly south-west of a line between Kalbarri and Esperance, extending along the south coast to Cape Arid National Park (Commonwealth of Australia 2017), with birds foraging in Proteaceous woodlands and shrublands in coastal areas from January to July, then moving inland to woodlands with suitable nesting hollows during the breeding season of late July to December (Saunders 1980). Carnaby's Cockatoo occurs in

uncleared or remnant native eucalypt woodlands and shrubland or kwongan heathland dominated by *Hakea*, *Banksia*, and *Grevillea* species. It is a seasonal visitor to plantations of exotic Pines (*Pinus* spp.), and sometimes occurs in forests.

The survey area falls within the species' range with the *Banksia* Woodlands of the survey area providing very high quality foraging habitat for this species. Ecoscape considers that Carnaby's Cockatoo has a high likelihood of occurring within the survey area.

#### **Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – VU EPBC status; VU BC status/DBCA status**

Forest Red-tailed Black Cockatoo was formerly common but is now rare to uncommon and patchily distributed over a range which has become markedly reduced (DSEWPac 2012). This taxon usually occurs in pairs or small flocks, seldom large flocks (up to 200) and has declined due to destruction of forests and woodlands and competition for nest hollows with native and exotic species, and the impact of fire.

Its Commonwealth mapped distribution includes the survey area and the desktop assessment identified that it has been recorded nearby. The *Banksia* Woodland habitat within the survey area contains high quality foraging habitat for this species. Ecoscape considers that Forest Red-tailed Black Cockatoo has a high likelihood of occurring within the survey area.

#### **Western Brush Wallaby (*Notamacropus irma*) – P4 DBCA status**

The Western Brush Wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland and is uncommon in Karri forest (DCE 2010).

The species has recently been recorded in the adjacent Mather Reserve (Ecoscape 2018). However, due to the small and isolated extents of habitat which are mostly fenced off from surrounding areas, and the presence of predators, it is less likely to be present in the survey area. Ecoscape considers that the Western Brush Wallaby has a medium likelihood of occurring within the survey area.

#### **Quenda (*Isodon fusciventer*) – P4 DBCA status**

Quenda are widely distributed from near the coast from Guilderton (north of Perth) to the east of Esperance. They also have a patchy distribution through the Jarrah and Karri forest, the Swan Coastal Plain, and inland as far as Hyden. Quenda have been recorded in swampy vegetation with dense cover up to 1 m high, often feeding in adjacent forest and woodland that is burnt on a regular basis, and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quenda will thrive in more open habitat subject to introduced predator control. On the Swan Coastal Plain, Quenda are often associated with wetlands (DEC 2012).

There is only moderate suitable habitat for Quenda in the survey area, habitat quality is reduced due to fragmentation and predator presence.

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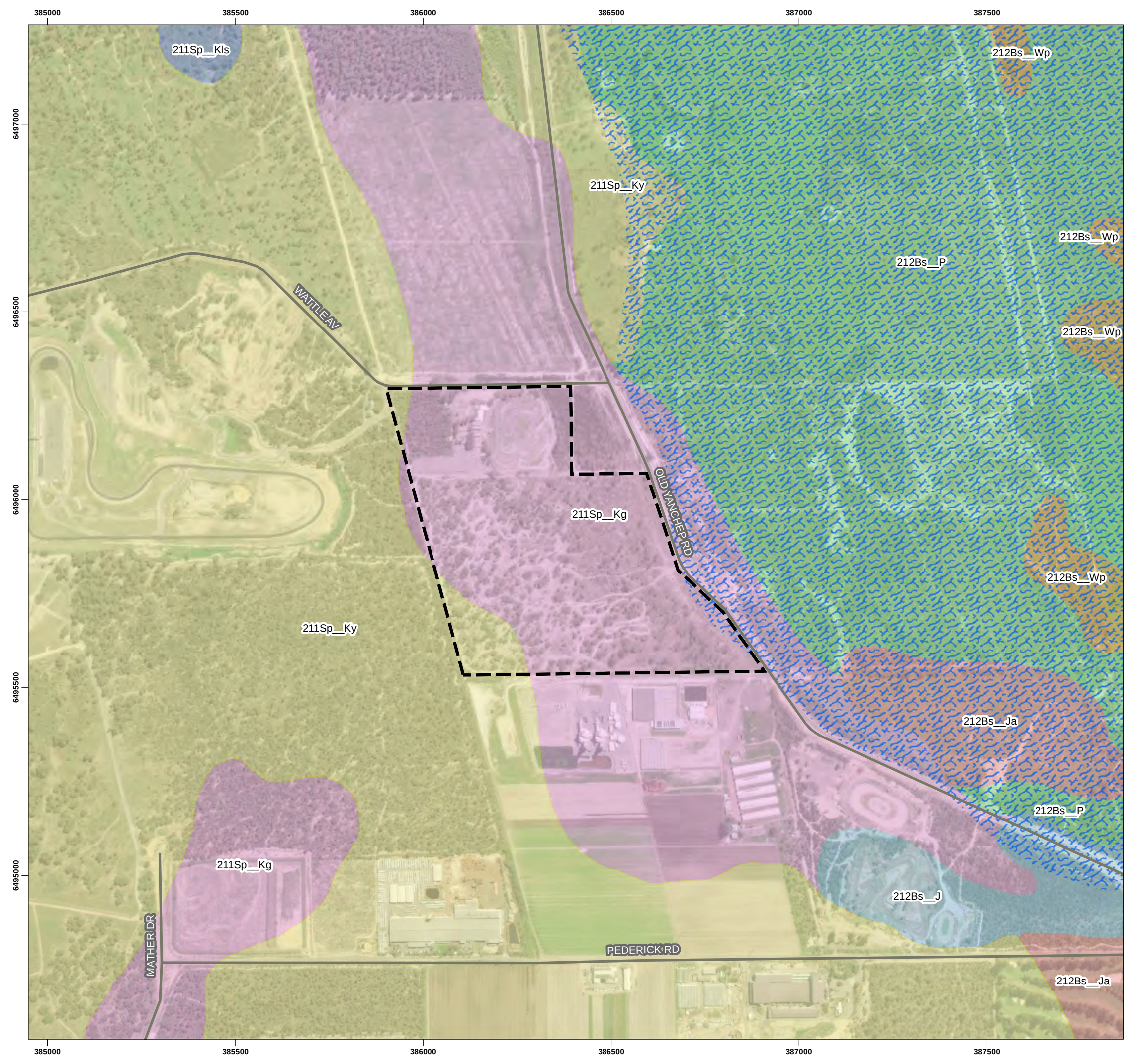
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# MAPS





LEGEND

- Survey Area
- Roads
- Lake Pinjar Geomorphic Wetland (Sumpland, Conservation)

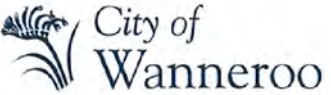
Soil Land Systems

- 211Sp\_Kg: Low hilly to gently undulating terrain. Iron podzols. *Banksia* spp woodland with *E. todtiana* and depauperate *E. marginata*; dense shrub layer
- 211Sp\_Kls: Low hills and ridges. Bare limestone or shallow siliceous or calcareous sand over limestone. Dense low shrub dominated by *Dryandra sessilis*, *Melaleuca huegellii* and species of *Grevillea*
- 211Sp\_Ky: Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m. *Banksia* spp. woodland with scattered emergent *E. gomphocephala* and *E. marginata* and a dense shrub layer
- 212Bs\_J: Poorly drained depressions. Humus podzols. Scattered *M. preissiana*, *E. rudis* and *Banksia ilicifolia* with a dense shrub layer
- 212Bs\_Ja: Jandakot low dunes. Slopes less than 10% and generally more than 5m relief. Grey sand over pale yellow sands generally underlain by humic and iron podzols; *Banksia* spp. low open woodland with a dense shrub layer
- 212Bs\_P: Extensively flat swampy areas. Sandy surface sometimes with diatomite over organic hardpan below. *E. rudis*, *B. littoralis* and *M. preissiana* around the edges; sedges and reeds with scattered *M. teretifolius* in centre; *Jacksonia furcellata*
- 212Bs\_Wp: Depressions. Humus podzols and peats around the edges often with some diatomite zoned vegetation with heath on upper slopes. *Melaleuca* spp. and *E. rudis* at waters edge. Reeds and sedges in shallow water

**DATASOURCES:**  
SOURCE DATA: SOIL-LANDSCAPE MAPPING WESTERN AUSTRALIA - BEST AVAILABLE SOILS (2019); TRANSPORT ROAD CENTRELINES (MRWA 2012); GEOMORPHIC WETLANDS, SWAN COASTAL PLAIN (DBCA-019)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY



SOIL LANDSCAPE MAPPING  
NEERABUP INDUSTRIAL AREA  
ENVIRONMENTAL ASSESSMENTS - PORTION 2



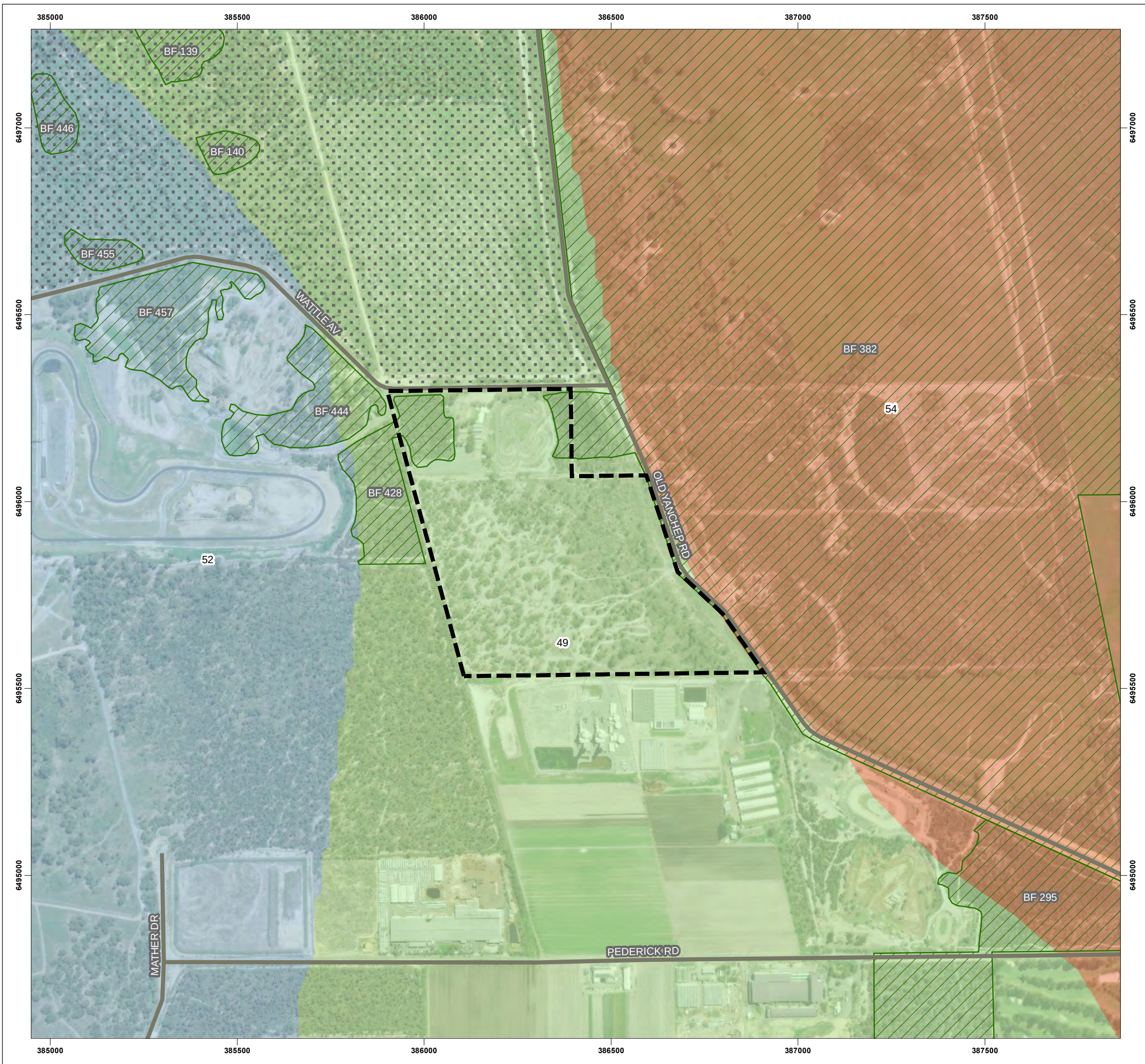
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER



PROJECT NO: 4591-20

| REV | AUTHOR | APPROVED | DATE       |
|-----|--------|----------|------------|
| 0   | KP     | SB       | 22/02/2021 |
|     |        |          |            |
|     |        |          |            |





**LEGEND**

Survey Area

Roads

Bush Forever Sites

Gnaragara-Moore River State Forest

**Vegetation Complexes**

52: Cottesloe Complex-Central and South - Woodland and open forest and closed heath

49: Karrakatta Complex-Central and South - Open forest and woodland

54: Pinjar Complex - Woodland to fringing woodland

**DATASOURCES :**  
SOURCE DATA: VEGETATION COMPLEXES - SWAN COASTAL PLAIN (DBCA-046); TRANSPORT ROAD CENTRELINES (MRWA 2012); BUSH FOREVER AREAS 2000 (DPLH-019); DBCA - LEGISLATED LANDS AND WATERS (DBCA-011)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**VEGETATION COMPLEXES**  
**NEERABUP INDUSTRIAL AREA**  
**ENVIRONMENTAL ASSESSMENTS – PORTION 2**

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER

SCALE: 1:10,000 @ A3  
0 80 160 240 320 400 m

PROJECT NO: 4591-20

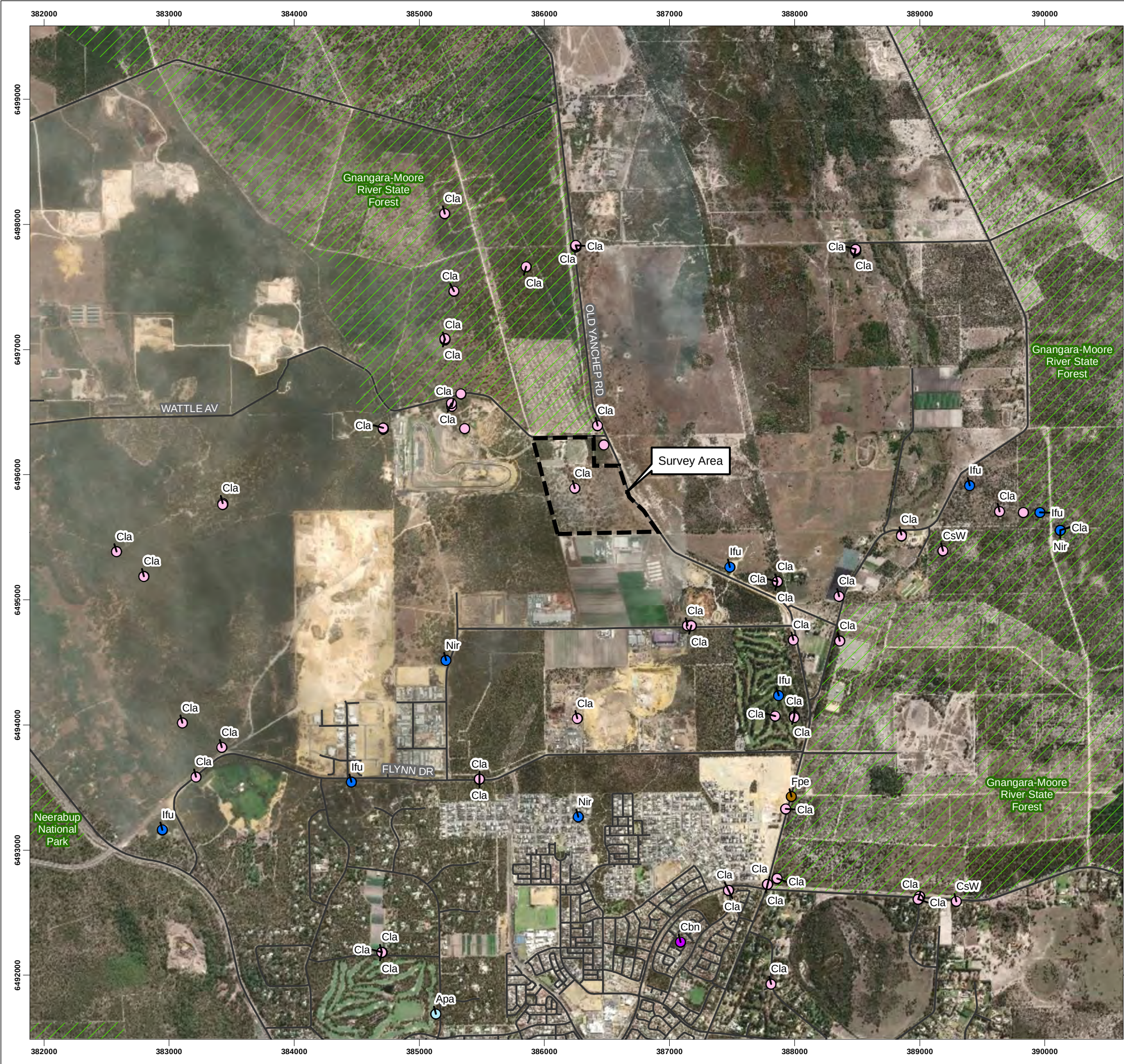
| REV | AUTHOR | APPROVED | DATE       |
|-----|--------|----------|------------|
| 1   | KP     | SB       | 22/02/2021 |
|     |        |          |            |
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**MAP**  
**2**









LEGEND

- Survey Area
- Roads
- DBCA Reserves

Conservation-listed Fauna (DBCA 2020)

- Endangered
- Vulnerable
- Migratory
- Other Specially Protected
- Priority 4

| Code | Taxon                                                    | Status |
|------|----------------------------------------------------------|--------|
| Apa  | <i>Apus pacificus</i>                                    | MI     |
| Cbn  | <i>Calyptorhynchus banksii naso</i>                      | VU     |
| Cla  | <i>Calyptorhynchus latirostris</i>                       | EN     |
| CsW  | <i>Calyptorhynchus</i> sp. 'white-tailed black cockatoo' | EN     |
| Fpe  | <i>Falco peregrinus</i>                                  | OS     |
| Ifu  | <i>Isodon fusciventer</i>                                | P4     |
| Nir  | <i>Notamacropus irma</i>                                 | P4     |

DATASOURCES:  
SOURCE DATA: FAUNA DATA (DBCA 2020); TRANSPORT ROAD CENTRELINES (MRWA 2012); DBCA LEGISLATED LANDS AND WATERS (DBCA-011)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

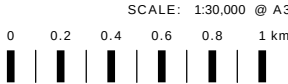


FAUNA DATABASE  
SEARCH RESULTS

NEERABUP INDUSTRIAL AREA  
ENVIRONMENTAL ASSESSMENTS - PORTION 2



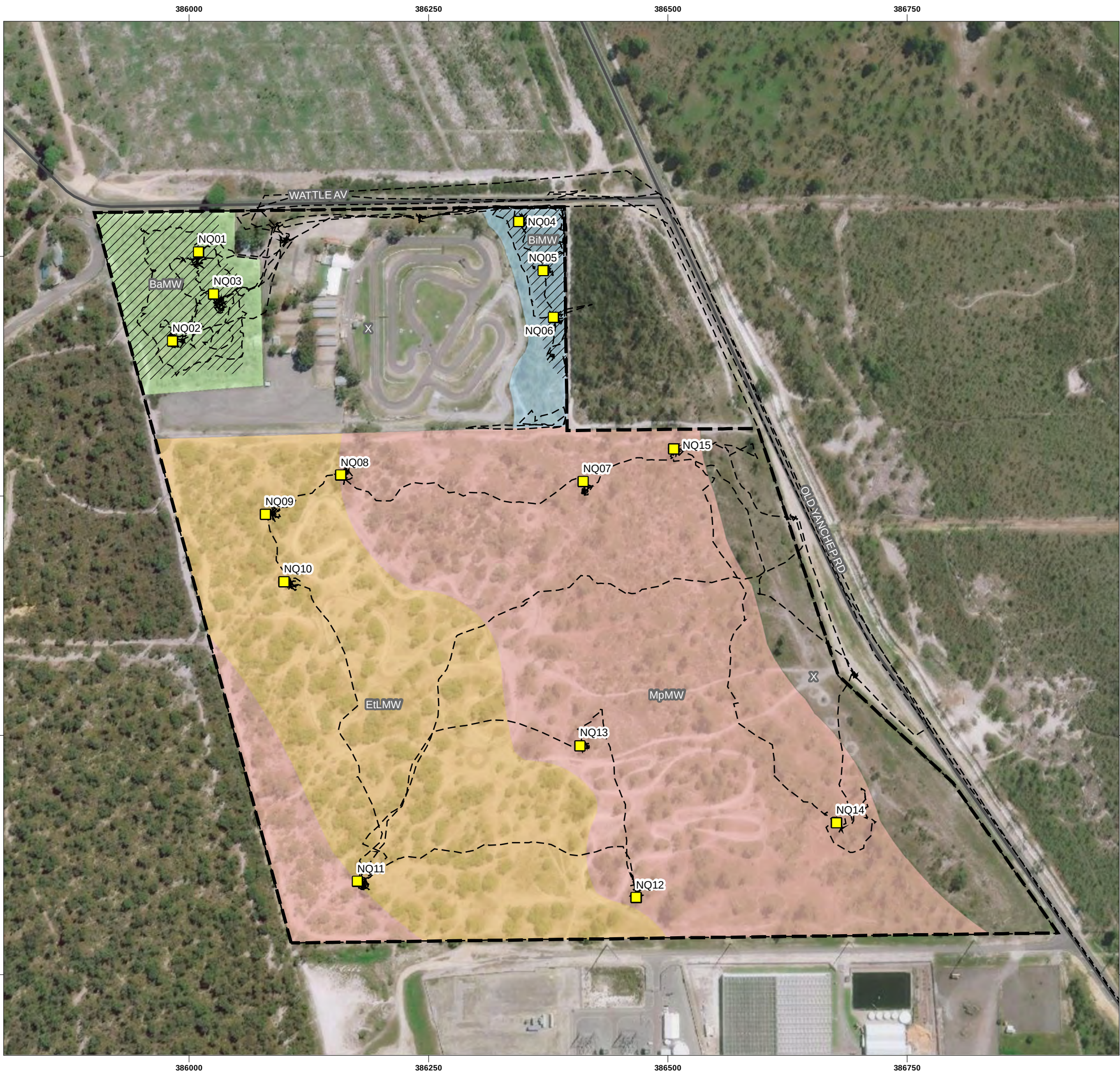
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER



PROJECT NO: 4591-20

| REV | AUTHOR | APPROVED | DATE       |
|-----|--------|----------|------------|
| 1   | KP     | SB       | 22/02/2021 |
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LEGEND

- Survey Area
- Survey Tracks
- Roads
- Quadrats
- TEC/PEC**
  - Banksia dominated woodlands of the Swan Coastal Plain TEC/PEC
- Vegetation Types**
  - BaMW: *Banksia attenuata* and *B.menziesii* mid woodland
  - BiMW: *Banksia ilicifolia* mid woodland
  - ELMW: *Eucalyptus tottiana* and *Nuytsia floribunda* mid mallee woodland
  - MpMW: *Melaleuca preissiana* and *Eucalyptus rudis* subsp. *rudis* mid woodland
  - X: No vegetation (cleared)

**DATASOURCES :**  
SOURCE DATA: FLORA DATA (ECOSCAPE 2020); TRANSPORT ROAD CENTRELINES (MRWA 2012)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

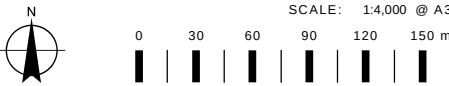
**ecoscape**

**VEGETATION TYPES AND  
QUADRAT LOCATIONS**

**NEERABUP INDUSTRIAL AREA  
ENVIRONMENTAL ASSESSMENTS - PORTION 2**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER



PROJECT NO: 4591-20

| REV | AUTHOR | APPROVED | DATE       |
|-----|--------|----------|------------|
| 0   | KP     | SB       | 22/02/2021 |
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|     |        |          |            |

**MAP  
5**





**LEGEND**

-  Survey Area  
 Roads
- Vegetation Condition**
-  Very Good  
 Good  
 Degraded  
 N/A

- Quadrat Condition**
-  Very Good  
 Degraded

- Significant Weeds**
-  \**Asparagus asparagoides*  
 \**Moraea miniata*

**DATASOURCES :**  
SOURCE DATA: FLORA DATA (ECOSCAPE 2020); TRANSPORT ROAD CENTRELINES (MRWA 2012)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

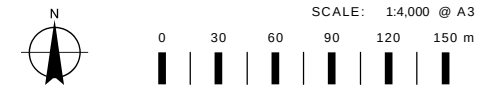


**VEGETATION CONDITION & SIGNIFICANT WEEDS**

**NEERABUP INDUSTRIAL AREA  
ENVIRONMENTAL ASSESSMENTS - PORTION 2**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER



PROJECT NO: 4591-20

| REV | AUTHOR | APPROVED | DATE       |
|-----|--------|----------|------------|
| 0   | KP     | SB       | 22/02/2021 |





LEGEND

- Survey Area
- Roads
- Fauna Assessment Points
- Fauna Habitat**
  - BW: *Banksia* Woodland
  - DW: Degraded Woodland (*Eucalyptus tottiana*, *Melaleuca preissiana*, *Eucalyptus rudis*)
  - X: No habitat
- Habitat Trees**
  - Eucalyptus marginata***
    - Class 4
    - Class 5
  - Eucalyptus rudis***
    - Class 4
    - Class 5

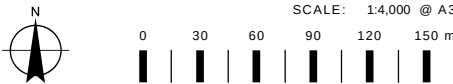
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SOURCE DATA: FAUNA DATA (ECOSCAPE 2020); TRANSPORT ROAD CENTRELINES (MRWA 2012)  
AERIAL: ESRI BASEMAP (2019)  
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



**FAUNA SITES AND HABITAT**  
**NEERABUP INDUSTRIAL AREA**  
**ENVIRONMENTAL ASSESSMENTS - PORTION 2**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50  
PROJECTION: TRANSVERSE MERCATOR  
DATUM: GDA 1994  
UNITS: METER



PROJECT NO: 4591-20

| REV | AUTHOR | APPROVED | DATE       |
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| 0   | KP     | SB       | 22/02/2021 |
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## APPENDIX ONE

## DEFINITIONS AND CRITERIA

**Table 16: EPBC Act categories for flora, fauna, and ecological communities**

| Category                          | Threatened species                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Threatened Ecological Communities                                                                                                                                                                                                                                                                                                    |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Extinct</b>                    | A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                                                                                                                                                                                                                                                                                                                                  |
| <b>Extinct in the wild</b>        | A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time:<br>(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or<br>(b) it 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.                                                                                                                                                                                                                                                                                                                                                                                                    | n/a                                                                                                                                                                                                                                                                                                                                  |
| <b>Critically Endangered (CE)</b> | A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria                                               |
| <b>Endangered (EN)</b>            | A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time:<br>(a) it is not critically endangered; and<br>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time:<br>(a) it is not critically endangered; and<br>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.                 |
| <b>Vulnerable (VU)</b>            | A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time:<br>(a) it is not critically endangered or endangered; and<br>(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time:<br>(a) it is not critically endangered or endangered; and<br>(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria. |
| <b>Conservation Dependent</b>     | A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:<br>(a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered, or critically endangered; or<br>(b) the following subparagraphs are satisfied:<br>(i) the species is a species of fish.<br>(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised.<br>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory.<br>(iv) cessation of the plan of management would adversely affect the conservation status of the species. | n/a                                                                                                                                                                                                                                                                                                                                  |



Table 17: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

| Conservation Codes for Western Australian Flora and Fauna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Threatened, Extinct and Specially Protected fauna or flora <sup>1</sup> are species <sup>2</sup> which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| The <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> and the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> have been transitioned under regulations 170, 171 and 172 of the <i>Biodiversity Conservation Regulations 2018</i> to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the <i>Biodiversity Conservation Act 2016</i> .                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Categories of Threatened, Extinct and Specially Protected fauna and flora are:                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>T</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Threatened species</b></p> <p>Listed by order of the Minister as Threatened in the category of critically endangered, endangered, or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna.</p> <p>Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p> |
| <b>CR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Critically endangered species</b></p> <p>Threatened species considered to be "<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>".</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.</p>                                                                                                                                                                                                                                                       |
| <b>EN</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Endangered species</b></p> <p>Threatened species considered to be "<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>".</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.</p>                                                                                                                                                                                                                                                                                                              |
| <b>VU</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Vulnerable species</b></p> <p>Threatened species considered to be "<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>".</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.</p>                                                                                                                                                                                                                                                                                                            |
| <b>Extinct species</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>EX</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Extinct species</b></p> <p>Species where "<i>there is no reasonable doubt that the last member of the species has died</i>", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>EW</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Extinct in the wild species</p> <p>Species that "<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p>                                                                                                                                                                                                             |
| <b>Specially protected species</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</b></p> <p><b>Species that are listed as threatened species (critically endangered, endangered, or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Conservation Codes for Western Australian Flora and Fauna |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MI</b>                                                 | <p><b>Migratory species</b></p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p> |
| <b>CD</b>                                                 | <p><b>Species of special conservation interest (conservation dependent fauna)</b></p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).</p> <p>Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>OS</b>                                                 | <p><b>Other specially protected species</b></p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p> <p>Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>P</b>                                                  | <p><b>Priority species</b></p> <p>Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.</p> <p>Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>                                                                                                                                                                                                                 |
| <b>1</b>                                                  | <p><b>Priority 1: Poorly-known species</b></p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>2</b>                                                  | <p><b>Priority 2: Poorly-known species</b></p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>3</b>                                                  | <p><b>Priority 3: Poorly-known species</b></p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Conservation Codes for Western Australian Flora and Fauna                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4                                                                                                                                                                                                                          | <b>Priority 4: Rare, Near Threatened and other species in need of monitoring</b>                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                            | (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. |
|                                                                                                                                                                                                                            | (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.                                                                                                                                      |
|                                                                                                                                                                                                                            | (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.                                                                                                                                                                                   |
| <sup>1</sup> The definition of flora includes algae, fungi, and lichens.                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                      |
| <sup>2</sup> Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population). |                                                                                                                                                                                                                                                                                                                      |

Table 18: DBCA definitions and criteria for TECs and PECs (DEC 2013)

| Criteria                                 | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Threatened Ecological Communities</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Presumed Totally Destroyed (PD)          | <p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <ul style="list-style-type: none"> <li>A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</li> <li>B. All occurrences recorded within the last 50 years have since been destroyed</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Critically Endangered (CR)               | <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> <li>A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): <ul style="list-style-type: none"> <li>i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years).</li> <li>ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</li> </ul> </li> <li>B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> <li>i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years).</li> <li>ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes.</li> <li>iii. there may be many occurrences, but total area is very small, and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</li> </ul> </li> <li>C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</li> </ul> |



| Criteria                               | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Endangered (EN)                        | <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <ul style="list-style-type: none"> <li>A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): <ul style="list-style-type: none"> <li>i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years).</li> <li>ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.</li> </ul> </li> <li>B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> <li>i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years).</li> <li>ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes.</li> <li>iii. there may be many occurrences, but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.</li> </ul> </li> </ul> <p>The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p> |
| Vulnerable (VU)                        | <p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> <li>A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</li> <li>B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.</li> <li>C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Priority ecological communities</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Priority One                           | <p><i>Poorly known ecological communities</i></p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Priority Two                           | <p><i>Poorly known ecological communities</i></p> <p>Communities that are known from few small occurrences, all, or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Criteria              | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Priority Three</b> | <p><i>Poorly known ecological communities</i></p> <ul style="list-style-type: none"> <li>i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or.</li> <li>ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or.</li> <li>iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</li> </ul> <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p> |
| <b>Priority Four</b>  | <p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> <li>i. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.</li> <li>ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</li> <li>iii. Ecological communities that have been removed from the list of threatened communities during the past five years.</li> </ul>                                                 |
| <b>Priority Five</b>  | <p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

**Table 19: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group; DotEE 2017)**

|                                            | Cover characteristics |                              |                    |                         |                           |                          |                                    |                                     |
|--------------------------------------------|-----------------------|------------------------------|--------------------|-------------------------|---------------------------|--------------------------|------------------------------------|-------------------------------------|
|                                            | Foliage cover *       | 70-100                       | 30-70              | 10-30                   | <10                       | > 0 (scattered)          | 0-5 (clumped)                      | unknown                             |
|                                            | Cover code            | d                            | c                  | i                       | r                         | bi                       | bc                                 | unknown                             |
| Growth Form                                | Height Ranges (m)     | Structural Formation Classes |                    |                         |                           |                          |                                    |                                     |
| <b>tree, palm</b>                          | <10,10-30, >30        | closed forest                | open forest        | woodland                | open woodland             | isolated trees           | isolated clumps of trees           | tree, palm                          |
| <b>tree mallee</b>                         | <3, <10, 10-30        | closed mallee forest         | open mallee forest | mallee woodland         | open mallee woodland      | isolated mallee trees    | isolated clumps of mallee trees    | tree mallee                         |
| <b>shrub, cycad, grass-tree, tree-fern</b> | <1,1-2,>2             | closed shrubland             | shrubland          | open shrubland          | sparse shrubland          | isolated shrubs          | isolated clumps of shrubs          | shrub, cycad, grass-tree, tree-fern |
| <b>mallee shrub</b>                        | <3, <10, 10-30        | closed mallee shrubland      | mallee shrubland   | open mallee shrubland   | sparse mallee shrubland   | isolated mallee shrubs   | isolated clumps of mallee shrubs   | mallee shrub                        |
| <b>heath shrub</b>                         | <1,1-2,>2             | closed heathland             | heathland          | open heathland          | sparse heathland          | isolated heath shrubs    | isolated clumps of heath shrubs    | heath shrub                         |
| <b>chenopod shrub</b>                      | <1,1-2,>2             | closed chenopod shrubland    | chenopod shrubland | open chenopod shrubland | sparse chenopod shrubland | isolated chenopod shrubs | isolated clumps of chenopod shrubs | chenopod shrub                      |
| <b>samphire shrub</b>                      | <0.5,>0.5             | closed samphire shrubland    | samphire shrubland | open samphire shrubland | sparse samphire shrubland | isolated samphire shrubs | isolated clumps of samphire shrubs | samphire shrub                      |
| <b>hummock grass</b>                       | <2,>2                 | closed hummock grassland     | hummock grassland  | open hummock grassland  | sparse hummock grassland  | isolated hummock grasses | isolated clumps of hummock grasses | hummock grass                       |
| <b>tussock grass</b>                       | <0.5,>0.5             | closed tussock grassland     | tussock grassland  | open tussock grassland  | sparse tussock grassland  | isolated tussock grasses | isolated clumps of tussock grasses | tussock grass                       |
| <b>other grass</b>                         | <0.5,>0.5             | closed grassland             | grassland          | open grassland          | sparse grassland          | isolated grasses         | isolated clumps of grasses         | other grass                         |
| <b>sedge</b>                               | <0.5,>0.5             | closed sedgeland             | sedgeland          | open sedgeland          | sparse sedgeland          | isolated sedges          | isolated clumps of sedges          | sedge                               |
| <b>rush</b>                                | <0.5,>0.5             | closed rushland              | rushland           | open rushland           | sparse rushland           | isolated rushes          | isolated clumps of rushes          | rush                                |
| <b>herb</b>                                | <0.5,>0.5             | closed herbland              | herbland           | open herbland           | sparse herbland           | isolated herbs           | isolated clumps of herbs           | herb                                |
| <b>fern</b>                                | <1,1-2,>2             | closed fernland              | fernland           | open fernland           | sparse fernland           | isolated ferns           | isolated clumps of ferns           | fern                                |
| <b>bryophyte</b>                           | <0.5                  | closed bryophyte-land        | bryophyte-land     | open bryophyteland      | sparse bryophyteland      | isolated bryophytes      | isolated clumps of bryophytes      | bryophyte                           |
| <b>lichen</b>                              | <0.5                  | closed lichenland            | lichenland         | open lichenland         | sparse lichenland         | isolated lichens         | isolated clumps of lichens         | lichen                              |
| <b>vine</b>                                | <10,10-30, >30        | closed vineland              | vineland           | open vineland           | sparse vineland           | isolated vines           | isolated clumps of vines           | vine                                |



**Table 20: NVIS height classes (NVIS Technical Working Group; DotEE 2017)**

| Height       |                  | Growth form                               |                                                                                                               |                           |                                                                         |                                      |
|--------------|------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------|--------------------------------------|
| Height Class | Height Range (m) | Tree, vine (M & U), palm (single-stemmed) | Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed) | Tree mallee, mallee shrub | Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G) | Bryophyte, lichen, seagrass, aquatic |
| 8            | >30              | tall                                      | NA                                                                                                            | NA                        | NA                                                                      | NA                                   |
| 7            | 10-30            | mid                                       | NA                                                                                                            | tall                      | NA                                                                      | NA                                   |
| 6            | <10              | low                                       | NA                                                                                                            | mid                       | NA                                                                      | NA                                   |
| 5            | <3               | NA                                        | NA                                                                                                            | low                       | NA                                                                      | NA                                   |
| 4            | >2               | NA                                        | tall                                                                                                          | NA                        | tall                                                                    | NA                                   |
| 3            | 1-2              | NA                                        | mid                                                                                                           | NA                        | tall                                                                    | NA                                   |
| 2            | 0.5-1            | NA                                        | low                                                                                                           | NA                        | mid                                                                     | tall                                 |
| 1            | <0.5             | NA                                        | low                                                                                                           | NA                        | low                                                                     | low                                  |

Source: (based on Walker & Hopkins 1990)

**Table 21: Vegetation condition scale (Keighery 1994)**

| Condition rating    | Description                                                                                                                                                                                                                        |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pristine            | No obvious signs of disturbance                                                                                                                                                                                                    |
| Excellent           | Vegetation structure intact, disturbance only affecting individual species and weeds are non-aggressive species                                                                                                                    |
| Very Good           | Vegetation structure altered, obvious signs of disturbance e.g.: repeated fires, aggressive weeds, dieback, logging, and grazing                                                                                                   |
| Good                | Vegetation structure altered, obvious signs of disturbance. Retains basic vegetation structure or ability to regenerate it. The presence of very aggressive weeds at high density, partial clearing, dieback, logging, and grazing |
| Degraded            | Basic vegetation structure severely impacted by disturbance. Requires intensive management. The presence of very aggressive weeds at high density, partial clearing, dieback, logging, and grazing                                 |
| Completely Degraded | Vegetation structure is no longer intact, and the area is completely or almost completely without native flora. 'Parkland Cleared'                                                                                                 |

**Table 22: Grading system for the assessment of potential nest trees for Black Cockatoos (Bamford M 2016)**

| Class | Description of tree and hollows/activity                                                                                                                                                                                                                                          |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Active nest observed; adult (or immature) bird seen entering or emerging from hollow.                                                                                                                                                                                             |
| 2     | Hollow of suitable size and angle (i.e. near-vertical) visible with chew marks around entrance.                                                                                                                                                                                   |
| 3     | Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10m).                                                                          |
| 4     | Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black Cockatoos. |
| 5     | Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.                                                                                                                                      |

**Table 23: Commonwealth Black Cockatoo foraging quality scoring tool (Commonwealth of Australia 2017)**

| <b>Starting Score</b>         | <b>Foraging habitat for Carnaby's Cockatoo</b>                                                                                                                                                                                                                                                                                            | <b>Foraging habitat for Baudin's Cockatoo</b>                                                                                                                                                                                                                                     | <b>Foraging habitat for Forest Red-tailed Black cockatoo</b>                                                                                                                                                                                                                      |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10 (Very high quality)</b> | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of $\geq 10$                                                         | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of $\geq 10$ | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of $\geq 10$ |
| <b>7 (High quality)</b>       | Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under an RFA | Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under an RFA                                                                                                          | Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under an RFA                                                                             |
| <b>5 (Quality)</b>            | Pine plantation or introduced eucalypts                                                                                                                                                                                                                                                                                                   | Pine plantation or introduced eucalypts                                                                                                                                                                                                                                           | Pine plantation or introduced eucalypts                                                                                                                                                                                                                                           |
| <b>1 (Low quality)</b>        | Individual foraging plants or small stand of foraging plants                                                                                                                                                                                                                                                                              | Individual foraging plants or small stand of foraging plants                                                                                                                                                                                                                      | Individual foraging plants or small stand of foraging plants                                                                                                                                                                                                                      |
| <b>Additions</b>              | <b>Context adjustor - attributes improving functionality of foraging habitat</b>                                                                                                                                                                                                                                                          | <b>Context adjustor - attributes improving functionality of foraging habitat</b>                                                                                                                                                                                                  | <b>Context adjustor - attributes improving functionality of foraging habitat</b>                                                                                                                                                                                                  |
| <b>+3</b>                     | Is within the Swan Coastal Plain (important foraging area).                                                                                                                                                                                                                                                                               | Is within the known foraging area (see map).                                                                                                                                                                                                                                      | Jarrah and/or marri show good recruitment (i.e. evidence of young trees).                                                                                                                                                                                                         |
| <b>+3</b>                     | Contains trees with suitable nest hollows                                                                                                                                                                                                                                                                                                 | Contains trees with suitable nest hollows                                                                                                                                                                                                                                         | Contains trees with suitable nest hollows                                                                                                                                                                                                                                         |
| <b>+2</b>                     | Primarily contains marri                                                                                                                                                                                                                                                                                                                  | Primarily contains marri                                                                                                                                                                                                                                                          | Primarily contains marri and/or jarrah                                                                                                                                                                                                                                            |
| <b>+2</b>                     | Contains trees with potential to be used for breeding (dbh $\geq 500$ mm or $\geq 300$ mm dbh for salmon gum and wandoo)                                                                                                                                                                                                                  | Contains trees with potential to be used for breeding (dbh $\geq 500$ mm or $\geq 300$ mm dbh for salmon gum and wandoo)                                                                                                                                                          | Contains trees with potential to be used for breeding (dbh $\geq 500$ mm or $\geq 300$ mm dbh for salmon gum and wandoo)                                                                                                                                                          |
| <b>+1</b>                     | Is known to be a roosting site                                                                                                                                                                                                                                                                                                            | Is known to be a roosting site                                                                                                                                                                                                                                                    | Is known to be a roosting site                                                                                                                                                                                                                                                    |

| <b>Starting Score</b> | <b>Foraging habitat for Carnaby's Cockatoo</b>                                  | <b>Foraging habitat for Baudin's Cockatoo</b>                                   | <b>Foraging habitat for Forest Red-tailed Black cockatoo</b>                    |
|-----------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>Subtractions</b>   | <b>Context adjustor - attributes reducing functionality of foraging habitat</b> | <b>Context adjustor - attributes reducing functionality of foraging habitat</b> | <b>Context adjustor - attributes reducing functionality of foraging habitat</b> |
| <b>-2</b>             | No clear evidence of feeding debris                                             | No clear evidence of feeding debris                                             | No clear evidence of feeding debris                                             |
| <b>-2</b>             | No other foraging habitat within 6 km                                           | No other foraging habitat within 6 km                                           | No other foraging habitat within 6 km                                           |
| <b>-1</b>             | Is > 12 km from a known breeding location                                       | Is > 12 km from a known breeding location                                       | Is > 12 km from a known breeding location                                       |
| <b>-1</b>             | Is > 12 km from a known roosting site                                           | Is > 12 km from a known roosting site                                           | Is > 12 km from a known roosting site                                           |
| <b>-1</b>             | Is > 2 km from a watering point                                                 | Is > 2 km from a watering point                                                 | Is > 2 km from a watering point                                                 |
| <b>-1</b>             | Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)            | Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)            | Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)            |



## APPENDIX TWO                      TEC ASSESSMENT CRITERIA

### ***BANKSIA WOODLANDS* TEC**

The criteria outlined in the Approved Conservation Advice for the *Banksia Woodlands of the Swan Coastal Plain* TEC (TSSC 2016) was used to determine if the TEC occurs, as below.

The key characteristics for vegetation to be included in this TEC are that:

- it occurs on the Swan Coastal Plain IBRA region, including the Dandaragan Plateau and adjacent to the Jarrah Forest IBRA region on the lower parts of the Darling and Whicher escarpments
- it generally occurs on low-nutrient sandy substrates, including sandy colluvium and aeolean sands although may occur occasionally on other substrates (usually on the Bassendean and Spearwood sands)
- the structure is typically low woodland or forest with a distinct upper stratum of low trees dominated or co-dominated by one or more of four characteristic *Banksia* species (*Banksia attenuata*, *B. menziesii*, *B. prionotes*, *B. ilicifolia*) although emergent trees are sometimes present but cannot be the dominant stratum
- the understorey is typically a highly diverse shrub and herb layer
- it meets the thresholds in the table that follows (with vegetation type mapping extrapolated outside the survey area to be included in the extent calculations).

**Table 24: Condition categories and thresholds for inclusion in the *Banksia Woodlands* TEC** (TSSC 2016)

| Condition Threshold | Indicative Condition Measures (Typical)    |                                | Minimum Patch Size            |
|---------------------|--------------------------------------------|--------------------------------|-------------------------------|
|                     | Native Vegetation Composition <sup>1</sup> | Weed Cover                     |                               |
| Pristine            | Native plant species diversity             | Native plant species diversity | No minimum                    |
| Excellent           | High native plant species                  | High native plant species      | 0.5 ha / 5,000 m <sup>2</sup> |
| Very Good           | Moderate native plant species              | Moderate native plant species  | 1 ha / 10,000 m <sup>2</sup>  |
| Good                | Low native plant species                   | Low native plant species       | 2 ha / 20,000 m <sup>2</sup>  |
| Degraded            | Very low native plant species              | Very low native plant species  | Not representative            |
| Completely Degraded | Very low to no native species              | Very low to no native species  | Not representative            |

<sup>1</sup> Relative to expected natural range of diversity for that vegetation (e.g. Floristic Community Type; FCT), where comparative data exists.

Whilst FCTs, as defined in Gibson *et al.* (1994) can be used as a guide they do not necessarily define all vegetation that may be included in the TEC. Vegetation defined by Gibson *et al.* FCTs may be listed as TECs in Western Australia or as Priority Ecological Communities (PECs) by DBCA (combined into the EPBC-listed *Banksia Woodlands of the Swan Coastal Plain* TEC). Some *Banksia* woodlands on the eastern side of the Swan Coastal Plain (FCT 20 group) are not included in this TEC and have different conservation listings; these *Banksia* woodland types are not subject to the same thresholds as above to be considered representative of the relevant TEC or PEC.

## APPENDIX THREE      DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

**Table 25: Flora database search results, habitat, and likelihood assessment**

Blue shading indicates high likelihood

| DBCA*   | PMST** | Species name                                                                    | Habitat from:<br>• <i>FloraBase</i> (WAH 1998-2020)<br>• (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019) | Flowering           | Likelihood of occurrence |                 |
|---------|--------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|-----------------|
|         |        |                                                                                 |                                                                                                                                 |                     | Desktop                  | Post-survey     |
|         |        | <b>Threatened Flora***</b>                                                      |                                                                                                                                 |                     |                          |                 |
| WAH, TP | likely | <i>Caladenia huegelii</i> (EPBC Act - EN; BC Act – T)                           | Grey or brown sand. Clay loam.                                                                                                  | Sep-Oct             | Unlikely                 | Unlikely        |
| WAH, TP | known  | <i>Eucalyptus argutifolia</i> (EPBC Act - VU; BC Act – T)                       | Shallow soils over limestone. On slopes or in gullies of limestone ridges, outcrops                                             | Mar-Apr             | Unlikely                 | Unlikely        |
| WAH, TP | known  | <i>Melaleuca</i> sp. Wanneroo (G.J. Keighery 16705) (EPBC Act - EN; BC Act – T) | Limestone hills, slopes, and flats. Shallow soils over limestone, with outcropping limestone                                    | Oct-Jan             | Unlikely                 | Unlikely        |
|         |        | <b>DBCA Priority 1</b>                                                          |                                                                                                                                 |                     |                          |                 |
| WAH     | -      | <i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)                      | Slopes, hills, and flats. Yellow-grey sandy soils over limestone, with outcropping limestone                                    | Sep-Dec             | Unlikely                 | Unlikely        |
| WAH     | -      | <i>Drosera patens</i>                                                           | Sandy soils. Margins of winter-wet depressions, swamps, and lakes                                                               | Dec or Feb          | Possible                 | Unlikely        |
| WAH     | -      | <i>Drosera x sidjamesii</i>                                                     | Peaty sand. Along lake margins, close to winter high-water line                                                                 | Nov-Mar             | Unlikely                 | Unlikely        |
|         |        | <b>DBCA Priority 2</b>                                                          |                                                                                                                                 |                     |                          |                 |
| WAH, TP | -      | <i>Acacia benthamii</i>                                                         | On limestone breakaways                                                                                                         | Aug-Sep             | Unlikely                 | Unlikely        |
| WAH, TP | -      | <i>Calectasia elegans</i>                                                       | Flats and gentle slopes. Sandy soil                                                                                             | Sep-Nov             | Possible                 | Unlikely        |
| WAH     | -      | <i>Poranthera moorokatta</i>                                                    | Gently undulating plains, slopes, and crests of dunes. Sandy soil                                                               | Oct-Nov             | Possible                 | Unlikely        |
| WAH, TP | -      | <i>Stenanthemum sublineare</i>                                                  | Coastal plains. Sandy soil                                                                                                      | Oct-Dec             | Possible                 | Unlikely        |
|         |        | <b>DBCA Priority 3</b>                                                          |                                                                                                                                 |                     |                          |                 |
| WAH, TP | -      | <i>Conostylis bracteata</i>                                                     | Sand dunes. Sandy soil over limestone                                                                                           | Aug-Sep             | Unlikely                 | Unlikely        |
| WAH, TP | -      | <i>Cyathochaeta teretifolia</i>                                                 | Wetlands, creek edges. Sandy loam or peaty soil                                                                                 | Jan                 | Unlikely                 | Unlikely        |
| WAH     | -      | <i>Pimelea calcicola</i>                                                        | Coastal limestone ridges. Sandy soil                                                                                            | Sep-Nov             | Highly unlikely          | Highly unlikely |
| WAH     | -      | <i>Pithocarpa corymbulosa</i>                                                   | Amongst granite outcrops. Gravelly or sandy loam                                                                                | Jan-Apr             | Highly unlikely          | Highly unlikely |
| WAH     | -      | <i>Stylidium maritimum</i>                                                      | Dune slopes and flats. Sandy soil over limestone                                                                                | Sep-Nov             | Unlikely                 | Unlikely        |
| WAH     | -      | <i>Styphelia filifolia</i>                                                      | Flats, slopes. Yellow-brown sandy soil                                                                                          | Feb-Apr             | Unlikely                 | Unlikely        |
|         |        | <b>DBCA Priority 4</b>                                                          |                                                                                                                                 |                     |                          |                 |
| WAH, TP | -      | <i>Jacksonia sericea</i>                                                        | Plains, gentle slopes. Sandy soil, with outcropping limestone                                                                   | Dec-Feb             | Unlikely                 | Unlikely        |
| WAH, TP | -      | <i>Stylidium longitubum</i>                                                     | Seasonal wetlands. Sandy clay or clay soil                                                                                      | Oct-Dec             | Unlikely                 | Unlikely        |
| WAH, TP | -      | <i>Tripterococcus</i> sp. Brachylobus (A.S. George 14234)                       | Plains, wetlands and on gentle slopes. Sandy soil                                                                               | Jan-Mar and Oct-Dec | Unlikely                 | Unlikely        |

## DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

- \* WAH = herbarium record (vouchered specimen)  
 TP = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen  
 \*\* PMST likelihood of occurrence or likelihood of habitat occurring  
 \*\*\* Commonwealth EPBC Act and Western Australian BC Act conservation status

**Table 26: Fauna database results and likelihood assessments**

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area

| Species                             | Common name                      | Conservation status |                    | Database |      |           | Likelihood of occurrence |             |
|-------------------------------------|----------------------------------|---------------------|--------------------|----------|------|-----------|--------------------------|-------------|
|                                     |                                  | EPBC Act            | Western Australian | PMST*    | DBCA | NatureMap | Desktop                  | Post-survey |
| Mammals                             |                                  |                     |                    |          |      |           |                          |             |
| <i>Dasyurus geoffroii</i>           | Chuditch                         | VU                  | VU                 | Likely   |      |           | Very low                 | Very low    |
| <i>Isodon fusciventer</i>           | Quenda                           |                     | P4                 |          | X    | X         | High                     | High        |
| <i>Notamacropus irma</i>            | Western Brush Wallaby            |                     | P4                 |          | X    | X         | High                     | Medium      |
| Birds                               |                                  |                     |                    |          |      |           |                          |             |
| <i>Actitis hypoleucos</i>           | Common Sandpiper                 | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Apus pacificus</i>               | Fork-tailed Swift                | MI                  | MI                 | Likely   | X    |           | Low                      | Low         |
| <i>Ardea alba</i>                   | Great Egret                      |                     | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Ardea ibis</i>                   | Cattle Egret                     |                     | MI                 | May      |      |           | Very low                 | Very low    |
| <i>Botaurus poiciloptilus</i>       | Australasian Bittern             | EN                  | EN                 | May      |      |           | Very low                 | Very low    |
| <i>Calidris acuminata</i>           | Sharp-tailed Sandpiper           | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Calidris canutus</i>             | Red Knot                         | EN & MI             | EN                 | May      |      |           | Very low                 | Very low    |
| <i>Calidris ferruginea</i>          | Curlew Sandpiper                 | CR & MI             | CR                 | Known    |      |           | Very low                 | Very low    |
| <i>Calidris melanotos</i>           | Pectoral Sandpiper               | MI                  | MI                 | May      |      |           | Very low                 | Very low    |
| <i>Calidris ruficollis</i>          | Red-necked Stint                 | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Calidris subminuta</i>           | Long-toed Stint                  | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Charadrius ruficapillus</i>      | Red-capped Plover                | MA                  |                    | Known    |      |           | Very low                 | Very low    |
| <i>Calyptorhynchus banksii naso</i> | Forest Red-tailed Black Cockatoo | VU                  | VU                 | Likely   | X    |           | High                     | High        |
| <i>Calyptorhynchus latirostris</i>  | Carnaby's Cockatoo               | EN                  | EN                 | Known    | X    | X         | Recorded                 | High        |
| <i>Falco peregrinus</i>             | Peregrine Falcon                 |                     | OS                 |          | X    | X         | Medium                   | Low         |
| <i>Haliaeetus leucogaster</i>       | White-bellied Sea Eagle          |                     | MI                 | Known    |      |           | Very low                 | Very low    |



DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

| Species                              | Common name              | Conservation status |                    | Database |      |           | Likelihood of occurrence |             |
|--------------------------------------|--------------------------|---------------------|--------------------|----------|------|-----------|--------------------------|-------------|
|                                      |                          | EPBC Act            | Western Australian | PMST*    | DBCA | NatureMap | Desktop                  | Post-survey |
| <i>Himantopus himantopus</i>         | Black-winged Stilt       | MA                  |                    | Known    |      |           | Very low                 | Very low    |
| <i>Leipoa ocellata</i>               | Malleefowl               | VU                  | VU                 | Likely   |      |           | Very low                 | Very low    |
| <i>Merops ornatus</i>                | Rainbow Bee-eater        | MA                  |                    | May      |      |           | Medium                   | Recorded    |
| <i>Motacilla cinerea</i>             | Grey Wagtail             | MI                  | MI                 | May      |      |           | Very low                 | Very low    |
| <i>Numenius madagascariensis</i>     | Eastern Curlew           | CR                  | CR & MI            | May      |      |           | Very low                 | Very low    |
| <i>Pandion haliaetus</i>             | Osprey                   | MA & MI             |                    | Known    |      |           | Very low                 | Very low    |
| <i>Recurvirostra novaehollandiae</i> | Red-necked Avocet        | MA                  |                    | Likely   |      |           | Very low                 | Very low    |
| <i>Rostratula australis</i>          | Australian Painted Snipe | EN                  | EN                 | Likely   |      |           | Very low                 | Very low    |
| <i>Sternula nereis nereis</i>        | Australian Fairy Tern    | VU                  | VU                 | May      |      |           | Very low                 | Very low    |
| <i>Thinornis rubricollis</i>         | Hooded Plover            |                     | P4                 | May      |      |           | Very low                 | Very low    |
| <i>Tringa glareola</i>               | Wood Sandpiper           | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <i>Tringa nebularia</i>              | Common Greenshank        | MI                  | MI                 | Known    |      |           | Very low                 | Very low    |
| <b>Reptiles</b>                      |                          |                     |                    |          |      |           |                          |             |
| <i>Neelaps calonotos</i>             | Black-striped Snake      |                     | P3                 |          | X    |           | Medium                   | Low         |

\* PMST likelihood of occurrence or likelihood of habitat occurring

## APPENDIX FOUR FIELD SURVEY RESULTS

Table 27: Flora inventory (site x species)

| Family                  | Species                                              | Naturalised | NQ01 | NQ02 | NQ03 | NQ04 | NQ05 | NQ06 | NQ07 | NQ08 | NQ09 | NQ10 | NQ11 | NQ12 | NQ13 | NQ14 | NQ15 | Opportunistic |
|-------------------------|------------------------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------------|
| <b>Aizoaceae</b>        | <i>Carpobrotus edulis</i>                            | *           |      |      | x    |      |      |      | x    |      |      |      |      |      | x    | x    | x    | x             |
| <b>Anarthriaceae</b>    | <i>Lyginia barbata</i>                               |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Lyginia imberbis</i>                              |             |      |      |      | x    | x    | x    |      |      |      |      |      |      |      |      |      |               |
| <b>Apiaceae</b>         | <i>Xanthosia huegelii</i>                            |             |      | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Araliaceae</b>       | <i>Trachymene pilosa</i>                             |             | x    | x    | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |               |
| <b>Asparagaceae</b>     | <i>Asparagus asparagoides</i>                        | *           |      |      |      |      |      |      |      |      |      |      |      | x    |      |      |      |               |
|                         | <i>Thysanotus</i> sp.                                |             |      |      | x    |      |      | x    |      |      |      |      |      |      |      |      |      |               |
| <b>Asteraceae</b>       | <i>Hypochaeris glabra</i>                            | *           | x    |      | x    | x    |      | x    |      | x    | x    |      |      |      |      |      |      |               |
|                         | <i>Podotheca gnaphaloides</i>                        |             |      |      |      |      |      |      |      | x    | x    | x    | x    |      |      |      |      |               |
|                         | <i>Siloxerus humifusus</i>                           |             |      |      |      | x    |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Sonchus oleraceus</i>                             | *           |      |      |      |      |      |      |      |      |      |      |      |      |      | x    |      |               |
|                         | <i>Urospermum picroides</i>                          | *           |      |      |      |      |      |      |      | x    | x    | x    | x    |      |      |      |      |               |
|                         | <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> | *           | x    | x    |      |      | x    | x    |      |      | x    | x    | x    |      | x    | x    |      |               |
| <b>Campanulaceae</b>    | <i>Wahlenbergia capensis</i>                         | *           | x    |      |      |      |      |      |      | x    |      |      | x    |      |      |      |      |               |
|                         | <i>Wahlenbergia preissii</i>                         |             |      |      | x    | 2    |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Casuarinaceae</b>    | <i>Allocasuarina humilis</i>                         |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Centrolepidaceae</b> | <i>Centrolepis drummondiana</i>                      |             |      |      |      | x    |      | x    |      |      |      |      |      |      |      |      |      |               |
| <b>Colchicaceae</b>     | <i>Burchardia congesta</i>                           |             | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Crassulaceae</b>     | <i>Crassula colorata</i>                             |             |      |      | x    | x    |      |      | x    | x    |      |      | x    |      | x    | x    |      |               |
| <b>Cyperaceae</b>       | <i>Chaetospora curvifolia</i>                        |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | x             |
|                         | <i>Lepidosperma apricola</i>                         |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Lepidosperma</i> sp.                              |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      | x    |               |
|                         | <i>Tetragia octandra</i>                             |             | x    | x    | x    |      |      |      | x    |      |      |      |      |      |      |      |      |               |

FIELD SURVEY RESULTS

| Family        | Species                                                  | Naturalised | NQ01 | NQ02 | NQ03 | NQ04 | NQ05 | NQ06 | NQ07 | NQ08 | NQ09 | NQ10 | NQ11 | NQ12 | NQ13 | NQ14 | NQ15 | Opportunistic |
|---------------|----------------------------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------------|
| Dilleniaceae  | <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> |             | x    | x    | x    |      |      |      |      | x    |      | x    | x    |      | x    |      |      |               |
|               | <i>Hibbertia racemosa</i>                                |             | x    | x    |      | x    | x    | x    |      |      |      |      |      |      |      |      |      |               |
| Droseraceae   | <i>Drosera erythrorhiza</i>                              |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Drosera menziesii</i>                                 |             |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| Ericaceae     | <i>Brachyloma preissii</i>                               |             |      |      |      | x    | x    | x    |      |      |      | x    |      |      |      |      |      |               |
|               | <i>Conostephium pendulum</i>                             |             | x    | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Leucopogon polymorphus</i>                            |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Styphelia conostephioides</i>                         |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
| Euphorbiaceae | <i>Euphorbia terracina</i>                               | *           |      |      |      |      |      |      |      |      |      | x    | x    |      |      |      |      |               |
| Fabaceae      | <i>Acacia huegelii</i>                                   |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Acacia pulchella</i>                                  |             | x    | 2    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Bossiaea eriocarpa</i>                                |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Daviesia triflora</i>                                 |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Gompholobium tomentosum</i>                           |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Hardenbergia comptoniana</i>                          |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Jacksonia furcellata</i>                              |             |      |      |      | x    |      | x    |      |      |      |      |      |      |      |      | x    |               |
|               | <i>Jacksonia sternbergiana</i>                           |             |      |      | x    |      |      |      |      |      | x    |      |      |      |      |      |      |               |
|               | <i>Lotus subbiflorus</i>                                 | *           |      |      |      |      |      |      |      |      |      |      |      |      |      | x    |      |               |
|               | <i>Ornithopus compressus</i>                             | *           |      |      |      |      |      |      |      |      |      | x    | x    |      |      |      |      |               |
|               | <i>Trifolium dubium</i>                                  | *           |      |      |      |      |      |      |      |      |      | x    |      |      |      |      |      |               |
|               | <i>Pelargonium capitatum</i>                             | *           |      |      |      |      |      |      |      |      |      |      | x    |      |      |      |      |               |
| Goodeniaceae  | <i>Dampiera linearis</i>                                 |             |      |      |      | x    |      | x    |      |      |      |      |      |      |      |      |      |               |
| Haemodoraceae | <i>Anigozanthos humilis</i>                              |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Conostylis aculeata</i> subsp. <i>aculeata</i>        |             | x    | x    | x    | x    | x    | x    |      |      |      |      |      |      |      |      |      |               |
|               | <i>Conostylis juncea</i>                                 |             |      | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|               | <i>Phlebocarya ciliata</i>                               |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |

FIELD SURVEY RESULTS

| Family                   | Species                                         | Naturalised | NQ01 | NQ02 | NQ03 | NQ04 | NQ05 | NQ06 | NQ07 | NQ08 | NQ09 | NQ10 | NQ11 | NQ12 | NQ13 | NQ14 | NQ15 | Opportunistic |
|--------------------------|-------------------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------------|
| <b>Haloragaceae</b>      | <i>Gonocarpus pithyoides</i>                    |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Hemerocallidaceae</b> | <i>Corynotheca micrantha</i>                    |             |      |      | x    |      |      | x    |      |      | x    | x    |      | x    |      |      |      |               |
|                          | <i>Dianella revoluta</i> var. <i>divaricata</i> |             |      |      |      | x    | x    | x    | x    |      |      |      |      |      |      |      | x    |               |
|                          | <i>Tricoryne elatior</i>                        |             |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Iridaceae</b>         | <i>Gladiolus caryophyllaceus</i>                | *           | x    | x    | x    |      | x    | x    | x    |      | x    | x    | x    |      | x    |      |      |               |
|                          | <i>Moraea miniata</i>                           | *           |      |      |      |      |      |      | x    |      |      |      |      |      |      |      |      |               |
|                          | <i>Patersonia occidentalis</i>                  |             |      | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Lamiaceae</b>         | <i>Hemiandra pungens</i>                        |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Lauraceae</b>         | <i>Cassytha flava</i>                           |             | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Loganiaceae</b>       | <i>Phyllangium divergens</i>                    |             |      |      |      |      |      | x    |      |      |      |      |      |      |      |      |      |               |
| <b>Loranthaceae</b>      | <i>Nuytsia floribunda</i>                       |             |      | x    | x    |      |      |      |      | x    | x    | x    | x    | x    |      |      |      |               |
| <b>Montiaceae</b>        | <i>Calandrinia liniflora</i>                    |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Myrtaceae</b>         | <i>Astartea scoparia</i>                        |             |      |      |      |      |      |      | x    |      |      |      |      |      |      | x    |      |               |
|                          | <i>Beaufortia elegans</i>                       |             | x    |      | x    |      |      |      |      |      |      | x    |      |      |      |      |      |               |
|                          | <i>Calothamnus sanguineus</i>                   |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                          | <i>Calytrix fraseri</i>                         |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                          | <i>Eremaea pauciflora</i>                       |             |      | x    |      |      |      |      |      |      |      |      | x    |      |      |      |      |               |
|                          | <i>Eucalyptus marginata</i>                     |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | x             |
|                          | <i>Eucalyptus rudis</i> subsp. <i>rudis</i>     |             |      |      |      |      |      |      |      | x    |      |      |      | x    |      |      | x    |               |
|                          | <i>Eucalyptus tottiana</i>                      |             |      |      |      |      |      |      |      |      | x    | x    | x    |      |      |      |      |               |
|                          | <i>Hypocalymma angustifolium</i>                |             |      | x    | x    |      |      | x    |      |      |      |      |      |      |      |      |      |               |
|                          | <i>Kunzea glabrescens</i>                       |             |      |      |      | x    | x    | x    |      |      |      |      |      |      |      |      |      |               |
|                          | <i>Melaleuca preissiana</i>                     |             |      |      |      |      |      |      | x    |      |      |      |      | x    | x    | x    |      |               |
|                          | <i>Melaleuca seriata</i>                        |             |      | x    | x    |      |      |      |      |      |      |      | x    |      |      |      |      |               |
| <b>Orchidaceae</b>       | <i>Caladenia arenicola</i>                      |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                          | <i>Disa bracteata</i>                           | *           |      |      |      |      |      |      |      |      |      |      |      |      |      |      | x    |               |



FIELD SURVEY RESULTS

| Family       | Species                                           | Naturalised | NQ01 | NQ02 | NQ03 | NQ04 | NQ05 | NQ06 | NQ07 | NQ08 | NQ09 | NQ10 | NQ11 | NQ12 | NQ13 | NQ14 | NQ15 | Opportunistic |
|--------------|---------------------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------------|
|              | <i>Diuris corymbosa</i>                           |             |      |      |      |      |      |      |      |      | x    |      |      |      |      |      |      |               |
|              | <i>Microtis alba</i>                              |             |      |      |      |      |      |      |      |      |      |      | x    |      |      |      |      |               |
|              | <i>Pterostylis sanguinea</i>                      |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| Poaceae      | <i>Aira caryophyllaea</i>                         | *           |      |      |      |      |      |      | x    | x    | x    | x    | x    |      | x    | x    |      |               |
|              | <i>Austrostipa compressa</i>                      |             | x    | x    | x    |      | x    |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Briza maxima</i>                               | *           | x    | x    | x    | x    | x    |      |      | x    | x    | x    |      |      |      | x    |      |               |
|              | <i>Bromus diandrus</i>                            | *           |      |      |      |      |      |      |      | x    |      |      | x    | x    | x    | x    |      |               |
|              | <i>Ehrharta calycina</i>                          | *           | x    | x    | x    | x    |      |      | x    | x    | x    | x    | x    | x    | x    | x    | x    |               |
|              | <i>Ehrharta longiflora</i>                        | *           | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Lachnagrostis plebeia</i>                      |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Lolium rigidum</i>                             | *           |      |      |      |      |      |      | x    | x    |      | x    | x    | x    | x    |      | x    |               |
|              | <i>Neurachne</i> sp.                              |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Pentameris airoides</i>                        | *           | x    |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Rytidosperma caespitosum</i>                   |             |      |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Vulpia muralis</i>                             | *           | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Vulpia myuros</i>                              | *           |      |      |      |      |      |      | x    |      |      |      |      |      |      |      |      |               |
| Primulaceae  | <i>Lysimachia arvensis</i>                        | *           |      |      | x    |      |      |      |      |      |      |      |      |      | x    |      |      |               |
| Proteaceae   | <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> |             |      |      |      | x    | x    | x    |      | x    |      |      |      |      |      |      |      |               |
|              | <i>Banksia attenuata</i>                          |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Banksia ilicifolia</i>                         |             |      |      |      |      | x    | x    |      |      |      |      |      |      |      |      |      |               |
|              | <i>Banksia menziesii</i>                          |             | x    | x    | x    | x    |      | x    |      |      |      |      |      |      |      |      |      |               |
|              | <i>Persoonia saccata</i>                          |             |      |      |      |      | x    |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Petrophile linearis</i>                        |             |      | x    | x    |      |      |      |      |      |      |      | x    |      |      |      |      | x             |
|              | <i>Stirlingia latifolia</i>                       |             | x    |      |      |      |      |      |      |      |      | x    |      |      |      |      |      |               |
|              |                                                   |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| Restionaceae | <i>Alexgeorgea nitens</i>                         |             | x    | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|              | <i>Desmocladus flexuosus</i>                      |             | x    | x    | x    |      |      |      |      |      |      | x    | x    |      |      |      |      |               |

FIELD SURVEY RESULTS

| Family                  | Species                        | Naturalised | NQ01 | NQ02 | NQ03 | NQ04 | NQ05 | NQ06 | NQ07 | NQ08 | NQ09 | NQ10 | NQ11 | NQ12 | NQ13 | NQ14 | NQ15 | Opportunistic |
|-------------------------|--------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------------|
|                         | <i>Hypolaena exsulca</i>       |             |      |      |      |      |      |      |      |      |      |      |      |      | x    |      |      |               |
| <b>Rutaceae</b>         | <i>Philotheca spicata</i>      |             |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Stylidiaceae</b>     | <i>Levenhookia stipitata</i>   |             |      |      |      | x    |      | x    |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Stylidium araeophyllum</i>  |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Stylidium calcaratum</i>    |             | x    |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Stylidium crosscephalum</i> |             |      | x    |      |      |      |      |      |      |      |      |      |      |      |      |      | x             |
|                         | <i>Stylidium piliferum</i>     |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Stylidium repens</i>        |             | x    |      | x    | x    |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Thymelaeaceae</b>    | <i>Pimelea floribunda</i>      |             |      |      |      |      |      | x    |      |      |      |      |      |      |      |      |      |               |
| <b>Xanthorrhoeaceae</b> | <i>Xanthorrhoea preissii</i>   |             | x    | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
| <b>Zamiaceae</b>        | <i>Macrozamia fraseri</i>      |             | x    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |               |
|                         | <i>Macrozamia riedlei</i>      |             |      | x    |      |      |      |      |      |      |      | x    |      |      |      |      |      |               |

## FIELD SURVEY RESULTS

**Table 28: Fauna sites (GDA94, Zone 50)**

| Site Name   | Site Type                 | Habitat Unit           | Habitat Description                                              | Easting     | Northing    |
|-------------|---------------------------|------------------------|------------------------------------------------------------------|-------------|-------------|
| <b>HA01</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Banksia/Jarrah/shrubs                                            | 386005.504  | 6496262.99  |
| <b>HA02</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Banksia/Jarrah/shrubs                                            | 385962.769  | 6496191.568 |
| <b>HA03</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Jarrah/Wild Oats, edge                                           | 386007.303  | 6496125.542 |
| <b>HA04</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Coastal Blackbutt/Christmas Tree/grasses                         | 386024.465  | 6496065.312 |
| <b>HA05</b> | Fauna: Habitat Assessment | Cleared or Developed   | Cleared/Degraded/some shrubs                                     | 386347.267  | 6496078.841 |
| <b>HA06</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Melaleuca/Banksia/grasses                                        | 386358.716  | 6496124.198 |
| <b>HA07</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Banksia/ <i>Adenanthos</i> / <i>Kunzea</i> / <i>Jacksonia</i>    | 386363.0355 | 6496205.729 |
| <b>HA08</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Flooded Gum/Paperbark/grasses                                    | 386585.611  | 6495856.52  |
| <b>HA09</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Flooded Gum/Paperbark/grasses                                    | 386449.109  | 6496052.244 |
| <b>HA10</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Flooded Gum/Paperbark/ <i>Banksia ilicifolia</i> /sedges/grasses | 386407.781  | 6495912.882 |
| <b>HA11</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Flooded Gum/ <i>Adenanthos</i>                                   | 386252.253  | 6495941.438 |
| <b>HA12</b> | Fauna: Habitat Assessment | Woodland (Open/Closed) | Coastal Blackbutt/Christmas Tree/grasses                         | 386226.666  | 6495750.475 |

## FIELD SURVEY RESULTS

Table 29: Representative assessment sampling point images

| Point No.                                                                       | Image                                                                               |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <p><b>HA01</b></p> <p>Banksia/ Jarrah/ shrubs</p>                               |   |
| <p><b>HA04</b></p> <p>Coastal Blackbutt/ <i>Nuytsia floribunda</i>/ grasses</p> |  |



## FIELD SURVEY RESULTS

| Point No.                                                               | Image                                                                               |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <p><b>HA07</b></p> <p><b>Banksia/ Adenanthos/ Kunzea/ Jacksonia</b></p> |   |
| <p><b>HA08</b></p> <p><b>Flooded Gum/ Paperbark/ grasses</b></p>        |  |

## FIELD SURVEY RESULTS

| Point No.                                                                                    | Image                                                                               |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <p><b>HA10</b></p> <p>Flooded Gum/ Paperbark/ <i>Banksia ilicifolia</i>/ sedges/ grasses</p> |   |
| <p><b>HA12</b></p> <p>Coastal Blackbutt/ <i>Nuytsia floribunda</i>/ grasses</p>              |  |



Table 30: Potential Black Cockatoo Breeding Trees

| Potential Breeding Trees                                                           |                                                                                    |                                                                                     |                                                                                      |                                                                                      |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|   |   |   |   |   |
| T01 <i>Eucalyptus rudis</i>                                                        | T02 <i>Eucalyptus rudis</i>                                                        | T03 <i>Eucalyptus rudis</i>                                                         | T04 <i>Eucalyptus rudis</i>                                                          | T05 <i>Eucalyptus rudis</i>                                                          |
|  |  |  |  |  |
| T06 <i>Eucalyptus rudis</i>                                                        | T07 <i>Eucalyptus rudis</i>                                                        | T08 <i>Eucalyptus rudis</i>                                                         | T09 <i>Eucalyptus rudis</i>                                                          | T10 <i>Eucalyptus rudis</i>                                                          |



# FIELD SURVEY RESULTS

| Potential Breeding Trees                                                           |                                                                                    |                                                                                     |                                                                                      |                                                                                     |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|   |   |   |   |  |
| T11 <i>Eucalyptus rudis</i>                                                        | T12 <i>Eucalyptus rudis</i>                                                        | T13 <i>Eucalyptus rudis</i>                                                         | T14 <i>Eucalyptus marginata</i>                                                      | T15 <i>Eucalyptus rudis</i>                                                         |
|  |  |  |  |                                                                                     |
| T16 <i>Eucalyptus rudis</i>                                                        | T17 <i>Eucalyptus rudis</i>                                                        | Tag 261 <i>Eucalyptus marginata</i>                                                 | Tag 262 <i>Eucalyptus marginata</i>                                                  |                                                                                     |



## FIELD SURVEY RESULTS

**Table 31: Potential Black Cockatoo Breeding Trees (GDA94, Zone 50)**

| Tree Number  | DBH (mm) | Tree Species                | Tree Class (Bamford Scale) | Bees present | Easting  | Northing |
|--------------|----------|-----------------------------|----------------------------|--------------|----------|----------|
| <b>T01</b>   | 580      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386352.5 | 6496140  |
| <b>T02</b>   | 630      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386372.1 | 6496220  |
| <b>T03</b>   | 930      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386257.1 | 6496294  |
| <b>T04</b>   | 530      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386598.8 | 6495828  |
| <b>T05</b>   | 560      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386596.4 | 6495859  |
| <b>T06</b>   | 1160     | <i>Eucalyptus rudis</i>     | 4: hollows not suitable    | yes          | 386588.8 | 6495899  |
| <b>T07</b>   | 1010     | <i>Eucalyptus rudis</i>     | 4: hollows not suitable    | no           | 386545.3 | 6495918  |
| <b>T08</b>   | 670      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386432.6 | 6495968  |
| <b>T09</b>   | 700      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386372.2 | 6495947  |
| <b>T10</b>   | 530      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386322.7 | 6496010  |
| <b>T11</b>   | 580      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386344.6 | 6496050  |
| <b>T12</b>   | 560      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386282.7 | 6496025  |
| <b>T13</b>   | 600      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386275.5 | 6496026  |
| <b>T14</b>   | 570      | <i>Eucalyptus marginata</i> | 4: hollows not suitable    | no           | 386121.8 | 6495701  |
| <b>T15</b>   | 800      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386487.6 | 6495682  |
| <b>T16</b>   | 500      | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386704.5 | 6495693  |
| <b>T17</b>   | <Null>   | <i>Eucalyptus rudis</i>     | 5: no hollows              | no           | 386710.3 | 6495664  |
| <b>262 *</b> | 677      | <i>Eucalyptus marginata</i> | 5: no hollows              | no           | 386101.5 | 6495702  |
| <b>261 *</b> | 960      | <i>Eucalyptus marginata</i> | 5: no hollows              | no           | 386105.6 | 6495700  |

\*Trees were recorded in 2019 Neerabup Cockatoo Survey by Ecoscape



## NQ01

Staff JLT Date 29/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386009 mE 6496255 mN Lat. -31.6633 Long. 115.7976

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White basso sand

Rock Type

Loose Rock 0 % cover Litter 70 % cover ; 1-2 cm in depth

Bare ground 35 % cover Weeds 2 % cover

Vegetation U+ ^*Banksia attenuata*,^*Banksia menziesii*^tree\6\i;M ^*Beaufortia elegans*,^*Allocasuarina humilis*^shrub\4\r;G ^^*Hibbertia hypericoides* subsp. *hypericoides*,*Gompholobium tomentosum*,  
*Ehrharta calycina*^shrub,tussock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes Rabbit burrows nearby



| Species                      | WA Cons. | Height (m) | Cover (%) | Count |
|------------------------------|----------|------------|-----------|-------|
| <i>Acacia huegelii</i>       |          | .4         | <1        |       |
| <i>Acacia pulchella</i>      |          | .5         | 1.5       |       |
| <i>Alexgeorgea nitens</i>    |          | .15        | <1        |       |
| <i>Allocasuarina humilis</i> |          | 1.6        | 1         |       |



|                                                          |     |     |
|----------------------------------------------------------|-----|-----|
| <i>Anigozanthos humilis</i>                              | .25 | <1  |
| <i>Austrostipa compressa</i>                             | .45 | <1  |
| <i>Banksia attenuata</i>                                 | 5.5 | 15  |
| <i>Banksia menziesii</i>                                 | 5   | 11  |
| <i>Beaufortia elegans</i>                                | .6  | 8   |
| <i>Bossiaea eriocarpa</i>                                |     | <1  |
| * <i>Briza maxima</i>                                    | .15 | <1  |
| <i>Burchardia congesta</i>                               | .25 | <1  |
| <i>Caladenia arenicola</i>                               | .3  | <1  |
| <i>Calandrinia liniflora</i>                             | .05 | <1  |
| <i>Calothamnus sanguineus</i>                            | .6  | .5  |
| <i>Calytrix fraseri</i>                                  | .4  | <1  |
| <i>Cassytha flava</i>                                    |     | <1  |
| <i>Conostephium pendulum</i>                             |     | <1  |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i>        | .15 | 1   |
| <i>Daviesia triflora</i>                                 | .25 | .5  |
| <i>Desmocladius flexuosus</i>                            | .15 | <1  |
| <i>Drosera erythrorhiza</i>                              | .05 | <1  |
| * <i>Ehrharta calycina</i>                               | .6  | 1.5 |
| * <i>Ehrharta longiflora</i>                             | .25 | <1  |
| * <i>Gladiolus caryophyllaceus</i>                       | .6  | .25 |
| <i>Gompholobium tomentosum</i>                           | .35 | 2.5 |
| <i>Gonocarpus pithyoides</i>                             | .35 | <1  |
| <i>Hardenbergia comptoniana</i>                          | .4  | <1  |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .45 | 3   |
| <i>Hibbertia racemosa</i>                                | .45 | .2  |
| * <i>Hypochaeris glabra</i>                              | .05 | <1  |
| <i>Lachnagrostis plebeia</i>                             | .15 | <1  |
| <i>Lepidosperma apricola</i>                             | .5  | <1  |
| <i>Leucopogon polymorphus</i>                            | .45 | <1  |
| <i>Lyginia barbata</i>                                   | .35 | <1  |
| <i>Macrozamia fraseri</i>                                | .5  | <1  |
| <i>Neurachne</i> sp.                                     | .3  | <1  |
| * <i>Pentameris airoides</i>                             | .15 | <1  |
| <i>Phlebocarya ciliata</i>                               | .4  | 1.5 |
| <i>Pterostylis sanguinea</i>                             | .15 | <1  |
| <i>Stirlingia latifolia</i>                              | .35 | .5  |
| <i>Stylidium calcaratum</i>                              | .05 | <1  |

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|                                                        |     |    |
|--------------------------------------------------------|-----|----|
| <i>Stylidium repens</i>                                | .05 | <1 |
| <i>Styphelia conostephioides</i>                       | .6  | <1 |
| <i>Tetraria octandra</i>                               | .3  | .5 |
| <i>Trachymene pilosa</i>                               | .05 | <1 |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> | .15 | <1 |
| * <i>Vulpia muralis</i>                                | .2  | <1 |
| * <i>Wahlenbergia capensis</i>                         | .15 | <1 |
| <i>Xanthorrhoea preissii</i>                           | .5  | .5 |

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## NQ02

Staff JLT Date 29/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 385982 mE 6496162 mN Lat. -31.6641 Long. 115.7973

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 40 % cover ; 1-2 cm in depth

Bare ground 40 % cover Weeds 5 % cover

Vegetation U+ ^^*Banksia attenuata*,*Banksia menziesii*,*Nuytsia floribunda*^tree\6\i;M ^*Allocasuarina humilis*,  
^*Xanthorrhoea preissii*^shrub,tree\4\bi;G ^^*Hibbertia hypericoides* subsp. *hypericoides*,*Tetraria*  
*octandra*,*Ehrharta calycina*^shrub,sedge,tussock grass\\

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes Rabbit burrows nearby



| Species                   | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------|----------|------------|-----------|-------|
| <i>Acacia huegelii</i>    |          | .3         | .5        |       |
| <i>Acacia pulchella</i>   |          | .4         | <1        |       |
| <i>Acacia pulchella</i>   |          | .5         | <1        |       |
| <i>Alexgeorgea nitens</i> |          | .15        | <1        |       |

|                                                          |     |     |
|----------------------------------------------------------|-----|-----|
| <i>Allocasuarina humilis</i>                             | 1.3 | 2   |
| <i>Austrostipa compressa</i>                             | .4  | <1  |
| <i>Banksia attenuata</i>                                 | 5   | 15  |
| <i>Banksia menziesii</i>                                 | 4.5 | 8   |
| <i>Bossiaea eriocarpa</i>                                | .2  | <1  |
| * <i>Briza maxima</i>                                    | .3  | <1  |
| <i>Burchardia congesta</i>                               | .3  | <1  |
| <i>Cassytha flava</i>                                    | .5  | <1  |
| <i>Conostephium pendulum</i>                             | .35 | <1  |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i>        | .25 | <1  |
| <i>Conostylis juncea</i>                                 | .2  | <1  |
| <i>Desmocladus flexuosus</i>                             | .3  | <1  |
| <i>Drosera erythrorhiza</i>                              | .05 | <1  |
| <i>Drosera menziesii</i>                                 | .5  | <1  |
| * <i>Ehrharta calycina</i>                               | .4  | 1   |
| <i>Eremaea pauciflora</i>                                |     | 1   |
| * <i>Gladiolus caryophyllaceus</i>                       | .4  | <1  |
| <i>Gompholobium tomentosum</i>                           | .3  | <1  |
| <i>Gonocarpus pithyoides</i>                             | .4  | <1  |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .5  | 3   |
| <i>Hibbertia racemosa</i>                                | .35 | 1   |
| <i>Hypocalymma angustifolium</i>                         | .35 | <1  |
| <i>Leucopogon polymorphus</i>                            | .35 | <1  |
| <i>Lyginia barbata</i>                                   | .4  | <1  |
| <i>Macrozamia riedlei</i>                                | .6  | <1  |
| <i>Melaleuca leuropoma</i>                               | .4  | <1  |
| <i>Nuytsia floribunda</i>                                | 4   | 1   |
| <i>Patersonia occidentalis</i>                           | .4  | <1  |
| <i>Petrophile linearis</i>                               |     | <1  |
| <i>Philotheca spicata</i>                                |     | <1  |
| <i>Phlebocarya ciliata</i>                               | .35 | 2   |
| <i>Stylidium crosssocephalum</i>                         | .1  | <1  |
| <i>Styphelia conostephioides</i>                         | .5  | <1  |
| <i>Tetraria octandra</i>                                 | .4  | 1.5 |
| <i>Trachymene pilosa</i>                                 | .1  | <1  |
| <i>Tricoryne elatior</i>                                 | .2  | <1  |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>   | .25 | <1  |
| * <i>Vulpia muralis</i>                                  | .1  | <1  |



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|                              |     |    |
|------------------------------|-----|----|
| <i>Xanthorrhoea preissii</i> | .5  | 1  |
| <i>Xanthosia huegelii</i>    | .25 | <1 |

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## NQ03

**Staff** JLT **Date** 29/10/2020 **Season** A  
**Revisit**  
**Type** Q 10 m x 10 m  
**Location**  
**MGA Zone** 50 **386025 mE** **6496211 mN** **Lat.** -31.6637 **Long.** 115.7978  
**Habitat** Sandplain  
**Aspect** N/A **Slope** N/A  
**Soil Type** White sand  
**Rock Type**  
**Loose Rock** 0 % cover **Litter** 40 % cover ; 1-2 cm in depth  
**Bare ground** 40 % cover **Weeds** 5 % cover  
**Vegetation** U+ ^^*Banksia attenuata*,*Banksia menziesii*,*Nuytsia floribunda*\^tree\7i;M ^*Allocasuarina humilis*,  
^*Jacksonia sternbergiana*\^shrub\4r;G ^*Hibbertia hypericoides* subsp. *hypericoides*,*Beaufortia elegans*,*Styphelia conostephioides*\^shrub\1r  
**Veg. Condition** Excellent  
**Disturbance**  
**Fire Age** >5 years  
**Notes** Rabbit burrows nearby



| Species                      | WA Cons. | Height (m) | Cover (%) | Count |
|------------------------------|----------|------------|-----------|-------|
| <i>Acacia huegelii</i>       |          | .4         | <1        |       |
| <i>Acacia pulchella</i>      |          | 2          | <1        |       |
| <i>Alexgeorgea nitens</i>    |          | .15        | <1        |       |
| <i>Allocasuarina humilis</i> |          | 1.4        | 2         |       |

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|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| <i>Austrostipa compressa</i>                             | .25 | <1 |
| <i>Banksia attenuata</i>                                 | 5.5 | 10 |
| <i>Banksia menziesii</i>                                 | 5   | 4  |
| <i>Beaufortia elegans</i>                                | 1.5 | 4  |
| <i>Bossiaea eriocarpa</i>                                | .4  | .5 |
| * <i>Briza maxima</i>                                    | .3  | <1 |
| * <i>Carpobrotus edulis</i>                              | .35 | <1 |
| <i>Conostephium pendulum</i>                             | .5  | <1 |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i>        | .2  | 1  |
| <i>Conostylis juncea</i>                                 | .15 | <1 |
| <i>Corynotheca micrantha</i>                             | .45 | <1 |
| <i>Crassula colorata</i>                                 | .03 | <1 |
| <i>Desmocladus flexuosus</i>                             | .15 | <1 |
| <i>Drosera erythrorhiza</i>                              | .05 | <1 |
| * <i>Ehrharta calycina</i>                               | .45 | <1 |
| * <i>Gladiolus caryophyllaceus</i>                       | .45 | <1 |
| <i>Gompholobium tomentosum</i>                           | .4  | <1 |
| <i>Gonocarpus pithyoides</i>                             | .35 | <1 |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .5  | 5  |
| <i>Hypocalymma angustifolium</i>                         | .35 | .5 |
| * <i>Hypochaeris glabra</i>                              | .1  | <1 |
| <i>Jacksonia sternbergiana</i>                           | 1.8 | 1  |
| <i>Leucopogon polymorphus</i>                            | .4  | <1 |
| <i>Lyginia barbata</i>                                   | .35 | <1 |
| * <i>Lysimachia arvensis</i>                             | .15 | <1 |
| <i>Melaleuca leuropoma</i>                               | .45 | <1 |
| <i>Nuytsia floribunda</i>                                | 2   | 1  |
| <i>Patersonia occidentalis</i>                           | .35 | <1 |
| * <i>Pentameris airoides</i>                             | .15 | <1 |
| <i>Petrophile linearis</i>                               | .35 | <1 |
| <i>Phlebocarya ciliata</i>                               | .45 | <1 |
| <i>Rytidosperma caespitosum</i>                          | .2  | <1 |
| <i>Stylidium calcaratum</i>                              | .1  | <1 |
| <i>Stylidium repens</i>                                  | .05 | <1 |
| <i>Styphelia conostephioides</i>                         | .35 | 2  |
| <i>Tetraria octandra</i>                                 | .5  | <1 |
| <i>Thysanotus</i> sp.                                    | .5  | <1 |
| <i>Trachymene pilosa</i>                                 | .35 | <1 |

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|                              |     |    |
|------------------------------|-----|----|
| <i>*Vulpia muralis</i>       | .15 | <1 |
| <i>Wahlenbergia preissii</i> | .2  | <1 |
| <i>Xanthosia huegelii</i>    | .15 | <1 |

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## NQ04

**Staff** JLT **Date** 29/10/2020 **Season** A  
**Revisit**  
**Type** Q 10 m x 10 m  
**Location**  
**MGA Zone** 50 **386344 mE** **6496287 mN** **Lat.** -31.6631 **Long.** 115.8011  
**Habitat** Sandplain  
**Aspect** N/A **Slope** N/A  
**Soil Type** White sand  
**Rock Type**  
**Loose Rock** 0 % cover **Litter** 65 % cover ; 1-2 cm in depth  
**Bare ground** 30 % cover **Weeds** 5 % cover  
**Vegetation** U+ ^*Jacksonia furcellata*^tree\6\r;M ^*Adenanthos cygnorum* subsp. *cygnorum*,^*Kunzea glabrescens*^shrub\4\c;G ^^*Lyginia imberbis*,*Brachyloma preissii*,*Hibbertia racemosa*^sedge, shrub\2\i  
**Veg. Condition** Excellent  
**Disturbance**  
**Fire Age** >10 years  
**Notes**



| Species                                           | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------------------------|----------|------------|-----------|-------|
| <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> |          | 2.5        | 18        |       |
| <i>Banksia menziesii</i>                          |          | 1.6        | .5        |       |
| <i>Brachyloma preissii</i>                        |          | .45        | 5         |       |
| * <i>Briza maxima</i>                             |          | .25        | <1        |       |

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|                                                   |     |    |
|---------------------------------------------------|-----|----|
| <i>Centrolepis drummondiana</i>                   | .08 | <1 |
| <i>Conostephium pendulum</i>                      | .4  | <1 |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i> | .25 | <1 |
| <i>Crassula colorata</i>                          | .05 | <1 |
| <i>Dampiera linearis</i>                          | .25 | <1 |
| <i>Dianella revoluta</i> var. <i>divaricata</i>   | .4  | .5 |
| * <i>Ehrharta calycina</i>                        | .3  | <1 |
| <i>Hibbertia racemosa</i>                         | .35 | 2  |
| * <i>Hypochaeris glabra</i>                       | .05 | <1 |
| <i>Jacksonia furcellata</i>                       | 4   | 2  |
| <i>Kunzea glabrescens</i>                         | 3   | 14 |
| <i>Levenhookia stipitata</i>                      | .05 | <1 |
| <i>Lyginia imberbis</i>                           | .5  | 8  |
| <i>Siloxerus humifusus</i>                        | .02 | <1 |
| <i>Stylidium repens</i>                           | .05 | <1 |
| <i>Trachymene pilosa</i>                          | .05 | <1 |
| <i>Wahlenbergia preissii</i>                      | .25 | <1 |
| <i>Wahlenbergia preissii</i>                      | .05 | <1 |

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## NQ05

Staff JLT Date 29/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386370 mE 6496236 mN Lat. -31.6635 Long. 115.8014

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type Grey sand

Rock Type

Loose Rock 0 % cover Litter 60 % cover ; 2-3 cm in depth

Bare ground 45 % cover Weeds 1 % cover

Vegetation U+ ^*Banksia ilicifolia*^tree\6i;M ^*Kunzea glabrescens*,^*Adenanthos cygnorum* subsp. *cygnorum*^shrub\4c;G ^^*Lyginia imberbis*,*Brachyloma preissii*,*Hibbertia racemosa*^rush, shrub\2i

Veg. Condition Excellent

Disturbance

Fire Age >10 years

Notes



| Species                                           | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------------------------|----------|------------|-----------|-------|
| <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> |          | 2          | 5         |       |
| <i>Austrostipa compressa</i>                      |          | .45        | <1        |       |
| <i>Banksia ilicifolia</i>                         |          | 6          | 10        |       |
| <i>Brachyloma preissii</i>                        |          | .35        | 2         |       |

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|                                                       |     |    |
|-------------------------------------------------------|-----|----|
| <i>*Briza maxima</i>                                  | .3  | <1 |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i>     | .25 | <1 |
| <i>Dianella revoluta</i> var. <i>divaricata</i>       | .6  | <1 |
| <i>*Gladiolus caryophyllaceus</i>                     | .6  | <1 |
| <i>Hibbertia racemosa</i>                             | 4   | 1  |
| <i>Kunzea glabrescens</i>                             | 2.3 | 35 |
| <i>Lyginia imberbis</i>                               | .5  | 12 |
| <i>Persoonia saccata</i>                              | .5  | <1 |
| <i>Trachymene pilosa</i>                              | .15 | <1 |
| <i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i> | .15 | <1 |

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## NQ06

Staff JLT Date 29/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386380 mE 6496187 mN Lat. -31.6640 Long. 115.8015

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 65 % cover ; 2-3 cm in depth

Bare ground 20 % cover Weeds 1 % cover

Vegetation U+ ^*Banksia ilicifolia*,^*Banksia menziesii*^tree\6\i;M ^^*Kunzea glabrescens*,*Adenanthos cygnorum* subsp. *cygnorum*,*Jacksonia furcellata*^shrub\4\c;G ^*Lyginia imberbis*,^*Brachyloma preissii*^rush,shrub\2\i

Veg. Condition Excellent

Disturbance

Fire Age >10 years

Notes



| Species                                           | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------------------------|----------|------------|-----------|-------|
| <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> |          | 2          | 5         |       |
| <i>Banksia ilicifolia</i>                         |          | 6          | 8         |       |
| <i>Banksia menziesii</i>                          |          | 5          | 5         |       |
| <i>Brachyloma preissii</i>                        |          | .4         | 2         |       |

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|                                                        |     |    |
|--------------------------------------------------------|-----|----|
| <i>Centrolepis drummondiana</i>                        | .05 | <1 |
| <i>Conostylis aculeata</i> subsp. <i>aculeata</i>      | .25 | <1 |
| <i>Corynotheca micrantha</i>                           | .35 | <1 |
| <i>Dampiera linearis</i>                               | .15 | <1 |
| <i>Dianella revoluta</i> var. <i>divaricata</i>        | .45 | <1 |
| * <i>Gladiolus caryophyllaceus</i>                     | .6  | <1 |
| <i>Hibbertia racemosa</i>                              | .35 | <1 |
| <i>Hypocalymma angustifolium</i>                       | .7  | 1  |
| * <i>Hypochaeris glabra</i>                            | .15 | <1 |
| <i>Jacksonia furcellata</i>                            | 2   | 3  |
| <i>Kunzea glabrescens</i>                              | 2.5 | 45 |
| <i>Levenhookia stipitata</i>                           | .05 | <1 |
| <i>Lyginia imberbis</i>                                | .5  | 8  |
| <i>Phyllangium divergens</i>                           | .05 | <1 |
| <i>Pimelea floribunda</i>                              | .3  | <1 |
| <i>Thysanotus</i> sp.                                  | .25 | <1 |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> | .15 | <1 |

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## NQ07

**Staff** JLT **Date** 30/10/2020 **Season** A  
**Revisit**  
**Type** Q 10 m x 10 m  
**Location**  
**MGA Zone** 50 386411 mE 6496015 mN **Lat.** -31.6655 **Long.** 115.8018  
**Habitat** Sandplain  
**Aspect** N/A **Slope** N/A  
**Soil Type** White sand  
**Rock Type**  
**Loose Rock** 0 % cover **Litter** 20 % cover ; 1-2 cm in depth  
**Bare ground** 70 % cover **Weeds** 30 % cover  
**Vegetation** U+ ^*Melaleuca preissiana*^tree\7i;G ^^*Ehrharta calycina*,*Carpobrotus edulis*,*Dianella revoluta* var. *divaricata*^tussock grass,forb,sedge\2i  
**Veg. Condition** Degraded  
**Disturbance**  
**Fire Age** >10 years

## Notes



| Species                                         | WA Cons. | Height (m) | Cover (%) | Count |
|-------------------------------------------------|----------|------------|-----------|-------|
| <i>*Aira caryophylla</i>                        |          | .1         | 1         |       |
| <i>Astartea scoparia</i>                        |          | .8         | .5        |       |
| <i>*Carpobrotus edulis</i>                      |          | .05        | 5         |       |
| <i>Crassula colorata</i>                        |          | .05        | <1        |       |
| <i>Dianella revoluta</i> var. <i>divaricata</i> |          | .5         | 1         |       |

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|                                   |     |    |
|-----------------------------------|-----|----|
| <i>*Ehrharta calycina</i>         | .5  | 25 |
| <i>*Gladiolus caryophyllaceus</i> | .4  | <1 |
| <i>*Lolium rigidum</i>            | .25 | <1 |
| <i>Melaleuca preissiana</i>       | 10  | 20 |
| <i>*Moraea miniata</i>            | .25 | <1 |
| <i>Tetraria octandra</i>          | .3  | <1 |
| <i>*Vulpia myuros</i>             | .2  | <1 |

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## NQ08

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386158 mE 6496022 mN Lat. -31.6654 Long. 115.7991

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 30 % cover ; 1-2 cm in depth

Bare ground 60 % cover Weeds 40 % cover

Vegetation U+ ^*Eucalyptus rudis* subsp. *rudis*,^*Nuytsia floribunda*^tree\7i;M ^*Adenanthos cygnorum* subsp. *cygnorum*^shrub\4\bi;G ^*Ehrharta calycina*,^*Bromus diandrus*^tussock grass\

Veg. Condition Degraded

Disturbance

Fire Age >10 years

Notes



| Species                                           | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------------------------|----------|------------|-----------|-------|
| <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> |          | .4         | 1         |       |
| * <i>Aira caryophyllea</i>                        |          | .15        | <1        |       |
| * <i>Briza maxima</i>                             |          | .15        | <1        |       |
| * <i>Bromus diandrus</i>                          |          | .35        | 5         |       |
| <i>Crassula colorata</i>                          |          | .05        | <1        |       |

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|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| <i>*Ehrharta calycina</i>                                | .5  | 18 |
| <i>Eucalyptus rudis</i> subsp. <i>rudis</i>              | 8   | 12 |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .5  | <1 |
| <i>*Hypochaeris glabra</i>                               | .08 | <1 |
| <i>*Lolium rigidum</i>                                   | .25 | <1 |
| <i>Nuytsia floribunda</i>                                | 4   | 3  |
| <i>Podotheca gnaphalioides</i>                           | .1  | <1 |
| <i>*Urospermum picroides</i>                             | .15 | <1 |
| <i>*Wahlenbergia capensis</i>                            | .2  | <1 |

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## NQ09

**Staff** JLT **Date** 30/10/2020 **Season** A  
**Revisit**  
**Type** Q 10 m x 10 m  
**Location**  
**MGA Zone** 50 **386080 mE** **6495981 mN** **Lat.** -31.6658 **Long.** 115.7983  
**Habitat** Sandplain  
**Aspect** N/A **Slope** N/A  
**Soil Type** White sand  
**Rock Type**  
**Loose Rock** 0 % cover **Litter** 35 % cover ; 1-2 cm in depth  
**Bare ground** 40 % cover **Weeds** 20 % cover  
**Vegetation** U+ ^*Eucalyptus tottiana*,^*Nuytsia floribunda*^tree mallee,tree\6\i;M ^*Jacksonia sternbergiana*^shrub\4\bi;G ^*Ehrharta calycina*^tussock grass\2\i  
**Veg. Condition** Degraded  
**Disturbance**  
**Fire Age** >10 years

## Notes



| Species                      | WA Cons. | Height (m) | Cover (%) | Count |
|------------------------------|----------|------------|-----------|-------|
| * <i>Aira caryophyllea</i>   |          | .10        | <1        |       |
| * <i>Briza maxima</i>        |          | .15        | <1        |       |
| <i>Corynotheca micrantha</i> |          | .25        | <1        |       |
| <i>Diuris corymbosa</i>      |          | 0.4        | <1        |       |
| * <i>Ehrharta calycina</i>   |          | .5         | 12        |       |

---

|                                                        |     |    |
|--------------------------------------------------------|-----|----|
| <i>Eucalyptus todtiana</i>                             | 5   | 10 |
| * <i>Gladiolus caryophyllaceus</i>                     | .4  | <1 |
| * <i>Hypochaeris glabra</i>                            | .05 | <1 |
| <i>Jacksonia sternbergiana</i>                         | 2   | 2  |
| <i>Nuytsia floribunda</i>                              | 4   | 15 |
| <i>Podotheca gnaphalioides</i>                         | .14 | .5 |
| * <i>Urospermum picroides</i>                          | .15 | <1 |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> | .15 | <1 |

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## NQ10

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386099 mE 6495911 mN Lat. -31.6664 Long. 115.7985

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 30 % cover ; 1-2 cm in depth

Bare ground 40 % cover Weeds 20 % cover

Vegetation U+ ^*Eucalyptus tottiana*,^*Nuytsia floribunda*\^tree mallee,tree\6\i;M ^*Stirlingia latifolia*\^shrub\3\bi;  
G ^*Ehrharta calycina*,^*Aira caryophyllea*\^tussock grass\2\i

Veg. Condition Degraded

Disturbance

Fire Age >10 years

Notes



| Species                      | WA Cons. | Height (m) | Cover (%) | Count |
|------------------------------|----------|------------|-----------|-------|
| * <i>Aira caryophyllea</i>   |          | .1         | 1         |       |
| <i>Beaufortia elegans</i>    |          | .5         | <1        |       |
| <i>Brachyloma preissii</i>   |          | .5         | <1        |       |
| * <i>Briza maxima</i>        |          | .3         | <1        |       |
| <i>Corynotheca micrantha</i> |          | .4         | <1        |       |

---

|                                                          |     |     |
|----------------------------------------------------------|-----|-----|
| <i>Desmocladius flexuosus</i>                            | .15 | <1  |
| * <i>Ehrharta calycina</i>                               | .5  | 12  |
| <i>Eucalyptus todtiana</i>                               | 5   | 12  |
| * <i>Euphorbia terracina</i>                             | .4  | <1  |
| * <i>Gladiolus caryophyllaceus</i>                       | .4  | <1  |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .4  | .5  |
| * <i>Lolium rigidum</i>                                  | .2  | <1  |
| <i>Macrozamia riedlei</i>                                | .4  | <1  |
| <i>Nuytsia floribunda</i>                                | 4   | 3   |
| * <i>Ornithopus compressus</i>                           | .15 | <1  |
| <i>Podotherca gnaphalioides</i>                          | .15 | <1  |
| <i>Stirlingia latifolia</i>                              | 1   | 1.1 |
| * <i>Trifolium dubium</i>                                | .1  | <1  |
| * <i>Urospermum picroides</i>                            | .2  | <1  |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>   | .15 | <1  |

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## NQ11

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386176 mE 6495598 mN Lat. -31.6693 Long. 115.7993

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 40 % cover ; 1-2 cm in depth

Bare ground 40 % cover Weeds 20 % cover

Vegetation U+ ^*Eucalyptus tottiana*,^*Nuytsia floribunda*\^tree mallee,tree\6\i;G ^^*Ehrharta calycina*,*Eremaea pauciflora*,*Hibbertia hypericoides* subsp. *hypericoides*\^tussock grass,shrub\2\i

Veg. Condition Degraded

Disturbance

Fire Age >10 years

Notes



| Species                       | WA Cons. | Height (m) | Cover (%) | Count |
|-------------------------------|----------|------------|-----------|-------|
| * <i>Aira caryophyllea</i>    |          | .15        | .3        |       |
| * <i>Bromus diandrus</i>      |          | .35        | <1        |       |
| <i>Crassula colorata</i>      |          | .05        | <1        |       |
| <i>Desmocladius flexuosus</i> |          | .2         | <1        |       |
| * <i>Ehrharta calycina</i>    |          | .5         | 10        |       |

---

|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| <i>Eremaea pauciflora</i>                                | .25 | 2  |
| <i>Eucalyptus tottiana</i>                               | 5   | 18 |
| * <i>Euphorbia terracina</i>                             | .5  | <1 |
| * <i>Gladiolus caryophyllaceus</i>                       | .4  | <1 |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .4  | 1  |
| * <i>Lolium rigidum</i>                                  | .2  | <1 |
| <i>Melaleuca sericata</i>                                | .45 | <1 |
| <i>Microtis alba</i>                                     | .4  | <1 |
| <i>Nuytsia floribunda</i>                                | 5   | 5  |
| * <i>Ornithopus compressus</i>                           | .10 | <1 |
| * <i>Pelargonium capitatum</i>                           | .45 | <1 |
| <i>Petrophile linearis</i>                               | .4  | <1 |
| <i>Podotheca gnaphalioides</i>                           | .15 | <1 |
| * <i>Urospermum picroides</i>                            | .25 | <1 |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>   | .25 | <1 |
| * <i>Wahlenbergia capensis</i>                           | .25 | <1 |

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## NQ12

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386467 mE 6495581 mN Lat. -31.6694 Long. 115.8023

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type Grey sand

Rock Type

Loose Rock 0 % cover Litter 60 % cover ; 2-3 cm in depth

Bare ground 10 % cover Weeds 70 % cover

Vegetation U+ ^*Eucalyptus rudis* subsp. *rudis*, ^*Nuytsia floribunda* ^tree\7i; M ^*Melaleuca preissiana* ^tree\4r; G ^^*Ehrharta calycina*, *Corynotheca micrantha*, *Bromus diandrus* ^tussock grass, shrub\2c

Veg. Condition Degraded

Disturbance

Fire Age >10 years

Notes



| Species                                     | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------------------|----------|------------|-----------|-------|
| <i>*Asparagus asparagoides</i>              |          | .3         | 1         |       |
| <i>*Bromus diandrus</i>                     |          | .3         | 3         |       |
| <i>Corynotheca micrantha</i>                |          | .5         | 5         |       |
| <i>*Ehrharta calycina</i>                   |          | .5         | 40        |       |
| <i>Eucalyptus rudis</i> subsp. <i>rudis</i> |          | 18         | 20        |       |

---

|                             |     |    |
|-----------------------------|-----|----|
| <i>*Lolium rigidum</i>      | .35 | <1 |
| <i>Melaleuca preissiana</i> | 3   | 4  |
| <i>Nuytsia floribunda</i>   | 10  | 5  |

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## NQ13

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386408 mE 6495739 mN Lat. -31.6680 Long. 115.8017

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 30 % cover ; 1-2 cm in depth

Bare ground 50 % cover Weeds 50 % cover

Vegetation U+ ^Melaleuca preissiana\^tree\7i;G ^^Ehrharta calycina,Carpobrotus edulis,Aira caryophyllea\^tussock grass,forb\2i

Veg. Condition Degraded

Disturbance Adjacent to four wheel drive track

Fire Age >10 years

Notes



| Species             | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------|----------|------------|-----------|-------|
| *Aira caryophyllea  |          | .1         | 2         |       |
| *Bromus diandrus    |          | .35        | <1        |       |
| *Carpobrotus edulis |          | .15        | 5         |       |
| Crassula colorata   |          | .05        | <1        |       |
| *Ehrharta calycina  |          | .6         | 28        |       |

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|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| <i>*Gladiolus caryophyllaceus</i>                        | .4  | <1 |
| <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> | .4  | <1 |
| <i>Hypolaena exsulca</i>                                 | .45 | <1 |
| <i>*Lolium rigidum</i>                                   | .45 | <1 |
| <i>*Lysimachia arvensis</i>                              | .15 | <1 |
| <i>Melaleuca preissiana</i>                              | 15  | 30 |
| <i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i>    | .15 | <1 |

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## NQ14

Staff JLT Date 30/10/2020 Season A

Revisit

Type Q 10 m x 10 m

Location

MGA Zone 50 386676 mE 6495659 mN Lat. -31.6688 Long. 115.8046

Habitat Sandplain

Aspect N/A Slope N/A

Soil Type White sand

Rock Type

Loose Rock 0 % cover Litter 20 % cover ; 1-2 cm in depth

Bare ground 25 % cover Weeds 15 % cover

Vegetation U+ ^*Melaleuca preissiana*^tree\7i;M ^*Astartea scoparia*^shrub\4\bi;G ^*Ehrharta calycina*,  
^*Carpobrotus edulis*^tussock grass,chenopod shrub\2i

Veg. Condition Degraded

Disturbance

Fire Age >10 years

Notes



| Species                     | WA Cons. | Height (m) | Cover (%) | Count |
|-----------------------------|----------|------------|-----------|-------|
| * <i>Aira caryophyllea</i>  |          | .15        | .5        |       |
| <i>Astartea scoparia</i>    |          | 1.8        | 2         |       |
| * <i>Briza maxima</i>       |          | .2         | <1        |       |
| * <i>Bromus diandrus</i>    |          | .2         | <1        |       |
| * <i>Carpobrotus edulis</i> |          | .1         | 10        |       |

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|                                                        |     |    |
|--------------------------------------------------------|-----|----|
| <i>Crassula colorata</i>                               | .05 | <1 |
| * <i>Ehrharta calycina</i>                             | .6  | 12 |
| * <i>Lotus subbiflorus</i>                             | .05 | <1 |
| <i>Melaleuca preissiana</i>                            | 8   | 18 |
| * <i>Sonchus oleraceus</i>                             | .2  | <1 |
| * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> | .25 | <1 |

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## NQ15

**Staff** JLT **Date** 30/10/2020 **Season** A  
**Revisit**  
**Type** Q 10 m x 10 m  
**Location**  
**MGA Zone** 50 386506 mE 6496049 mN **Lat.** -31.6652 **Long.** 115.8028  
**Habitat** Sandplain  
**Aspect** N/A **Slope** N/A  
**Soil Type** White sand  
**Rock Type**  
**Loose Rock** 0 % cover **Litter** 10 % cover ; 1-2 cm in depth  
**Bare ground** 30 % cover **Weeds** 15 % cover  
**Vegetation** U+ ^*Eucalyptus rudis* subsp. *rudis*\^tree\7i;M ^*Jacksonia furcellata*\^shrub\4\bi;G ^*Ehrharta calycina*,^*Carpobrotus edulis*\^tussock grass,chenopod shrub\2i  
**Veg. Condition** Degraded  
**Disturbance**  
**Fire Age** >10 years

## Notes



| Species                                         | WA Cons. | Height (m) | Cover (%) | Count |
|-------------------------------------------------|----------|------------|-----------|-------|
| <i>*Carpobrotus edulis</i>                      |          | .15        | 5         |       |
| <i>Dianella revoluta</i> var. <i>divaricata</i> |          | .25        | <1        |       |
| <i>*Disa bracteata</i>                          |          | .3         | <1        |       |
| <i>*Ehrharta calycina</i>                       |          | .7         | 10        |       |
| <i>Eucalyptus rudis</i> subsp. <i>rudis</i>     |          | 20         | 18        |       |

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|                             |     |    |
|-----------------------------|-----|----|
| <i>Jacksonia furcellata</i> | 1.2 | 1  |
| <i>Lepidosperma</i> sp.     | .25 | <1 |
| * <i>Lolium rigidum</i>     | .2  | <1 |

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Op

|       |     |      |            |        |   |
|-------|-----|------|------------|--------|---|
| Staff | JLT | Date | 29/10/2020 | Season | A |
|-------|-----|------|------------|--------|---|

Revisit

|      |   |
|------|---|
| Type | Q |
|------|---|

Location

|          |    |    |      |       |
|----------|----|----|------|-------|
| MGA Zone | mE | mN | Lat. | Long. |
|----------|----|----|------|-------|

Habitat

|        |       |
|--------|-------|
| Aspect | Slope |
|--------|-------|

Soil Type

Rock Type

|            |        |
|------------|--------|
| Loose Rock | Litter |
|------------|--------|

|             |       |
|-------------|-------|
| Bare ground | Weeds |
|-------------|-------|

Vegetation

Veg. Condition

Disturbance

Fire Age

Notes

| Species                         | WA Cons. | Height (m) | Cover (%) | Count |
|---------------------------------|----------|------------|-----------|-------|
| <i>Chaetospora curvifolia</i>   |          | .35        | <1        |       |
| <i>Petrophile linearis</i>      |          | .35        | <1        |       |
| <i>Stylidium crossocephalum</i> |          | .25        | <1        |       |



**WESTERN**  
**ENVIRONMENTAL**

## **Lot 600, Old Yanchep Road and Orchid Road Neerabup**

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Basic Fauna and Targeted Black Cockatoo  
Habitat Assessment

**Western Environmental Pty Ltd**

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# Lot 600, Old Yanchep Road and Orchid Road Neerabup

## Basic Fauna and Targeted Black Cockatoo Habitat Assessment

**Report No:**

A25.002\_RPT\_FSR

**Issue Date:**

21-Apr-2025

**Status**

FINAL

**Prepared for:**

City of Wanneroo  
23 Dundobar Road  
Wanneroo WA 6065

**Prepared by**

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## Internal Review

| Author                                                                            | Reviewed by                                                                       | Approved by                                                                         |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |
| <b>Jack Rogers</b><br>Environmental Consultant                                    | <b>Andrew Fry</b><br>Associate Environmental Scientist                            | <b>Dale Newsome</b><br>Director                                                     |
| <b>26-Mar-2025</b>                                                                | <b>17-Apr-2025</b>                                                                | <b>21-Apr-2025</b>                                                                  |

## Distribution Record

| Copies | Document ID / Version     | Date        | Received by      |
|--------|---------------------------|-------------|------------------|
| 1      | A25.002_RPT_FSR_A.1_Draft | 21-Apr-2025 | City of Wanneroo |
| 2      | A25.002_RPT_FSR_FINAL     | 26-May-2025 | City of Wanneroo |
| 1      | A25.002_RPT_FSR_FINAL_V2  | 13-May-2026 | City of Wanneroo |



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In accordance with the scope of services, WEPL has conducted environmental field monitoring and/or testing in the preparation of this report. The nature and extent of monitoring and/or testing conducted is described in this report.

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WEPL will not be liable to update or revise this report to take into account any events or circumstances or facts becoming apparent after the date of this report.

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## Executive Summary

Western Environmental Pty Ltd was commissioned by the City of Wanneroo to undertake a Basic Fauna Survey and Targeted Black Cockatoo Habitat Survey of Lot 600, Old Yanchep Road and Orchid Road, Neerabup. The Survey Area is a 23.42 ha in size.

### Fauna

The Desktop likelihood of occurrence for conservation listed fauna species found that:

- One conservation listed fauna species *Zanda latirostris* (Carnaby's black cockatoo) Endangered (EN) was recorded as present.
- Three species had a high likelihood of occurrence.
- Two species had a medium likelihood of occurrence.
- Twenty-five species had a low likelihood of occurrence.

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) (EN)
- *Isodon fusciventer* (Quenda, southwestern brown bandicoot) Priority 4 (P4)
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) Priority 3 (P3)

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) Other Specially Protected
- *Synemon gratiosa* (Graceful sun-moth) P4

Five fauna habitat types were identified within the Survey Area. These habitats are not considered to provide core habitat services for any of the conservation significant species identified as present or having a high likelihood of occurrence. Supporting habitat is provided for six conservation significant species.

### Black Cockatoos

The Survey Area is within the modelled distribution for Carnaby's black cockatoo, and forest red-tailed black cockatoo. The Survey Area is outside of modelled breeding distribution for Baudin's black cockatoo and (DCCEEW, 2022).

### Black Cockatoo Breeding Habitat Assessment

No Potential or Known nesting trees were recorded within the Survey Area.



Fifty-nine Potential nesting trees were recorded within the Survey Area. Forty-four Potential future nesting trees were recorded within the Survey Area.

### **Black Cockatoo Foraging Habitat Assessment**

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (low, negligible or none value) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment. Foraging habitat was considered for Carnaby's black cockatoo, and forest red-tailed black cockatoo.

The Survey Area was assessed as containing 0.06 ha of suitable foraging habitat for Carnaby's black cockatoo and 0.02 ha of suitable foraging habitat for forest red-tailed black cockatoo. Foraging habitat quality extents within the Survey Area out of ten are:

- Carnaby's black cockatoo: 0.06 ha (8/10), 1.93 ha (6/10), 1.5 ha (2/10), 0.48 ha (1/10), 21.36 ha (0/10). Total of 0.06 ha of suitable foraging habitat and 23.34 ha of unsuitable foraging habitat.
- Forest red-tailed black cockatoo: 0.02 ha (7/10), 1.5 ha (2/10), 0.52 ha (1/10), 21.36 ha (0/10). Total of 0.02 ha of suitable foraging habitat and 23.4 ha of unsuitable foraging habitat.

Carnaby's black cockatoo foraging evidence (chewed banksia cones) was observed within the Survey Area.

### **Black Cockatoo Roosting Habitat Assessment**

No evidence of roosting was recorded. Habitat types FHT-01 contain stands of tall trees which may provide suitable roosting habitat. Access to water is present (in the nearby lake Joondalup and Lake Mariginiup).

## Acronyms and Abbreviations

| Abbreviation | Full Title                                                           |
|--------------|----------------------------------------------------------------------|
| BC Act       | <i>Biodiversity Conservation Act 2016</i>                            |
| BoM          | Bureau of Meteorology                                                |
| °C           | Degree Celsius                                                       |
| cm           | Centimetres                                                          |
| CR           | Critically Endangered                                                |
| DBCA         | Department of Biodiversity, Conservation and Attractions             |
| DBH          | Diameter at Breast Height                                            |
| DCCEEW       | Department of Climate Change, Energy, the Environment and Water      |
| DEWHA        | Department of the Environment Water Heritage and the Arts            |
| DPIRD        | Department of Primary Industries and Regional Development            |
| DWER         | Department of Water and Environmental Regulation                     |
| EIA          | Environmental Impact Assessment                                      |
| EN           | Endangered                                                           |
| EP Act       | <i>Environmental Protection Act 1986</i>                             |
| EPA          | Environmental Protection Authority                                   |
| EPBC Act     | <i>Environment Protection Biodiversity and Conservation Act 1999</i> |
| ESA          | Environmentally Sensitive Area                                       |
| GIS          | Geographic Information System                                        |
| ha           | Hectare                                                              |
| IBRA         | Interim Biogeographic Regionalisation for Australia                  |
| IBSA         | Index of Biodiversity Surveys for Assessments                        |
| km           | Kilometres                                                           |
| m            | Metres                                                               |
| mm           | Millimetres                                                          |
| MA           | Marine                                                               |
| MI           | Migratory                                                            |
| MNES         | Matters of National Environmental Significance                       |
| OS           | Other Specially Protected                                            |
| P            | Priority                                                             |
| PEC          | Priority Ecological Community                                        |
| PMST         | Protected Matters Search Tool                                        |
| RAAF         | Royal Australian Air Force                                           |
| SCP          | Swan Coastal Plain                                                   |

---

| Abbreviation | Full Title                            |
|--------------|---------------------------------------|
| T            | Threatened                            |
| TEC          | Threatened Ecological Community       |
| VU           | Vulnerable                            |
| WA           | Western Australia                     |
| WC Act       | <i>Wildlife Conservation Act 1950</i> |
| WEPL         | Western Environmental Pty Ltd         |

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## Appendices

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# 1. Introduction

## 1.1 Project Background

The City of Wanneroo (the 'City') received clearing permits from the Department of Water and Environmental Regulation (DWER) (CPS 6359/3) and approvals from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) (EPBC 2007/3479) in 2015 for the development of part of the Lot 600, Old Yanchep Road and Orchid Road Neerabup.

The City intends to apply for a clearing permit for another portion of Lot 600, facilitating its development for a resource recovery centre.

To support the clearing permit in addition to the ecological baseline information provided by Ecoscape (2020), the City commissioned Western Environmental Pty Ltd (WEPL) to undertake a Basic Fauna Survey and Targeted Black Cockatoo Habitat Survey of the additional portion of lot 600 Neerabup (hereby referred to as the 'Survey Area').

## 1.2 Location

Lot 600 Neerabup (the 'Survey Area') is located approximately 40 kilometres (km) north of the Perth CBD within the Local Government Area of the City of Wanneroo. The Survey Area consists of a 23.42 hectare (ha) portion of Lot 600 and is presented below in Figure 1.

## 1.3 Objectives and Scope of Work

Specifically, the scope of works included:

- A desktop assessment of the survey with a 10km buffer including:
  - Review of existing biological information.
  - Database searches.
  - Assessment of the likelihood of occurrence of conservation significant fauna species and communities.
- Basic Fauna Survey.
- Black Cockatoo Habitat Assessment.
- Preparation of a technical report detailing the findings of the desktop assessment and field survey.
- Preparation of a geospatial data package prepared in accordance with Index of Biodiversity Surveys for Assessments (IBSA) requirements.







---

## 1.4 Relevant Legislation and Guidance

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- *Western Australian Environmental Protection Act 1986* (EP Act).
- *Western Australian Biodiversity Conservation Act 2016* (BC Act).
- *Western Australian Biodiversity Conservation Regulations 2018*.
- Department of the Environment (DotE) (2013). *Matters of National Environmental Significance. Significant Impact Guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*.
- Department of the Environment Water Heritage and the Arts (DEWHA) (2010). *Survey Guidelines for Australia's Threatened Birds*.
- Department of Climate Change, Energy, Environment and Water (DCCEEW) (2022). *Referral Guidelines for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed black cockatoo*.
- DCCEEW (2023- unpublished resource). *Habitat Scoring System for WA black cockatoo foraging habitat'* (the Habitat Quality Scoring Tool)

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA. (2020). Technical Guidance – *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Known herein as the 'Fauna Survey Technical Guidance'.

A short description of key legislation is provided in Appendix A. Other definitions, including species and ecological community conservation categories, are provided in Appendix B.

## 1.5 Survey Limitations and Constraints

Limitations and constraints of the Basic Fauna Survey and Black Cockatoo Habitat Assessment as outlined in the Fauna Survey Technical Guidance are detailed below in Table 1.

**Table 1: Limitations and Constraints of the Fauna Survey**

| Possible Limitation                                                         | Degree of Limitation (Significant, Moderate or Negligible) | Potential Constraints on Survey Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Survey Level/ Scope</b>                                                  | Negligible                                                 | The Basic Fauna Survey and Targeted Black Cockatoo Habitat Assessment is considered suitable based on species expected to be present and the extent and condition of vegetation/habitat present within the Survey Area. The level of information collected is suitable to provide information required to inform and support approvals and referrals.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Availability of contextual information at a regional and local scale</b> | Negligible                                                 | All data required to complete the scope of works including regional and local contextual information was available. Department of Biodiversity Conservation and Attractions (DBCA) data was requested as part of the desktop assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Site Access</b>                                                          | Negligible                                                 | The Survey Area was readily accessed by vehicle and on foot.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Survey Intensity and Extent</b>                                          | Negligible                                                 | <p>Suitable survey effort by an experienced ecologist was applied. Survey effort include four person days of sampling of fauna and black cockatoo habitat.</p> <p>All planned Survey Areas were adequately sampled in line with the project scope of works. Survey effort for the Black Cockatoo Habitat Survey included every tree with a suitable DBH for support black cockatoo breeding as well as all areas of potential foraging and roosting habitat within the Survey Area boundary.</p> <p>All planned Survey Areas were adequately sampled in line with the project scope of works.</p>                                                                                                                                                                                                                  |
| <b>Experience</b>                                                           | Negligible                                                 | <p>The ecologist leading the Targeted Black Cockatoo Habitat Assessment; Jack Rogers has been conducting Basic Fauna Survey and Black Cockatoo Targeted Assessments in Western Australia for over a year. Jack Rogers is an experienced Ecologist from the UK who has over 3 years' experience in targeted fauna and ornithological surveys. Surveying Ecologist Renae Makin has over five years' experience in environmental consultancy and in undertaking fauna assessments.</p> <p>Technical support was provided by Andrew Fry who has been conducting fauna habitat assessments and black cockatoo targeted assessments in Western Australia for over 10 years including experience in the Swan Coastal Plain bioregion.</p>                                                                                 |
| <b>Timing, weather, season</b>                                              | Negligible                                                 | <p>The Targeted Black Cockatoo Habitat Assessment was undertaken within the recommended timing for both foraging and breeding habitat for forest red-tailed black cockatoo (year-round) but outside of the recommended timing for breeding habitat survey for Carnaby's black cockatoo (July to December) (DCCEEW, 2022). Baudin's black cockatoo are not expected to occur within the Survey Area. Targeted searches were undertaken for secondary evidence of the species presence (i.e. foraging evidence which can be identified at any time of year) and to evaluate the potential suitability of the habitat.</p> <p>The temperatures and weather experienced during both field surveys were not considered to be a limitation to the survey and did not affect the ability to record fauna or habitats.</p> |

| Possible Limitation                                                                        | Degree of Limitation (Significant, Moderate or Negligible) | Potential Constraints on Survey Outcomes                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                            |                                                            | A Basic fauna survey aims to identify core and support habitat for a wide assemblages of fauna species, The timing and weather were not considered a significant limitations to the survey as specific species were not surveyed for, while habitat classification was possible throughout year and in a range of climatic conditions.                 |
| Proportion of the flora and fauna recorded and/or collected, and any identification issues | Negligible                                                 | Species sampling was in line with the technical guidance for Basic Fauna survey and Targeted Black Cockatoo Habitat Assessment<br>Surveyors were able to accurately identify all vertebrate fauna species observed during the survey. Invertebrate species were not identified to species and are not included in the species inventory in Appendix F. |
| Mapping Reliability                                                                        | Negligible                                                 | The majority of the Survey Areas was traversed by foot and mapping reliability is considered high.                                                                                                                                                                                                                                                     |
| Disturbances (fire, flood etc.)                                                            | Negligible                                                 | No recent fire evidence was observed within the Survey Area, Survey Area disturbance was at a level expected for a degraded, mixed-use lot.                                                                                                                                                                                                            |

## 2. Existing Environment

### 2.1 Climate and Pre-Survey Rainfall

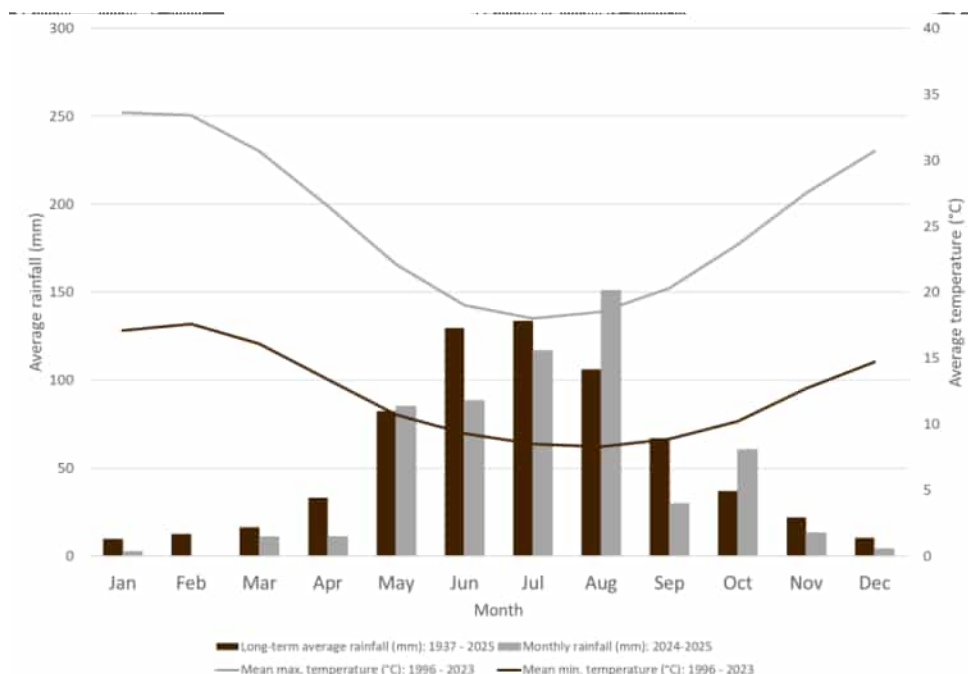
The Survey Area is located within the Swan Coastal Plain (SCP). In 1990, J. S. Beard (Beard, 1990) described the climate of the area as warm Mediterranean, with cool wet winters (May to September) and warm dry summers.

Climate results are presented using the closest long-term Bureau of Meteorology (BoM) weather station with a complete dataset. The station utilised for the Survey Area was the Pearce Royal Australian Air Force (RAAF) weather station (Station 009053).

Climate statistics were calculated utilising data from the most current climate normal, which is defined as a 30-year interval (BoM, 2007), where possible. A climate normal is a period long enough to include year-to-year variations while avoiding the influence of longer-term changes in climate.

The long-term (1940-2025) mean minimum temperature was 8.3°C (August) to 17.6 °C (February) and the long-term mean maximum temperature ranges from 17.9 C (July) to 33.6°C (January) as presented below in Graph 1 (BoM, 2024).

The Pearce RAAF WA weather station recorded 574 millimetres (mm) of rainfall in the 12 months prior to the survey (February 2024 to March 2025), which is 87 mm below the long-term average of 660 mm (BoM 2025).



**Graph 1: Long Term and Monthly Total Rainfall, Maximum and Minimum Temperatures for Pearce RAAF (Station 0092053) (BoM, 2024)**



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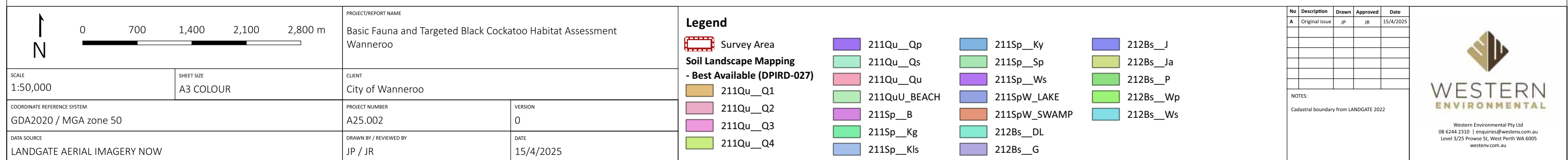
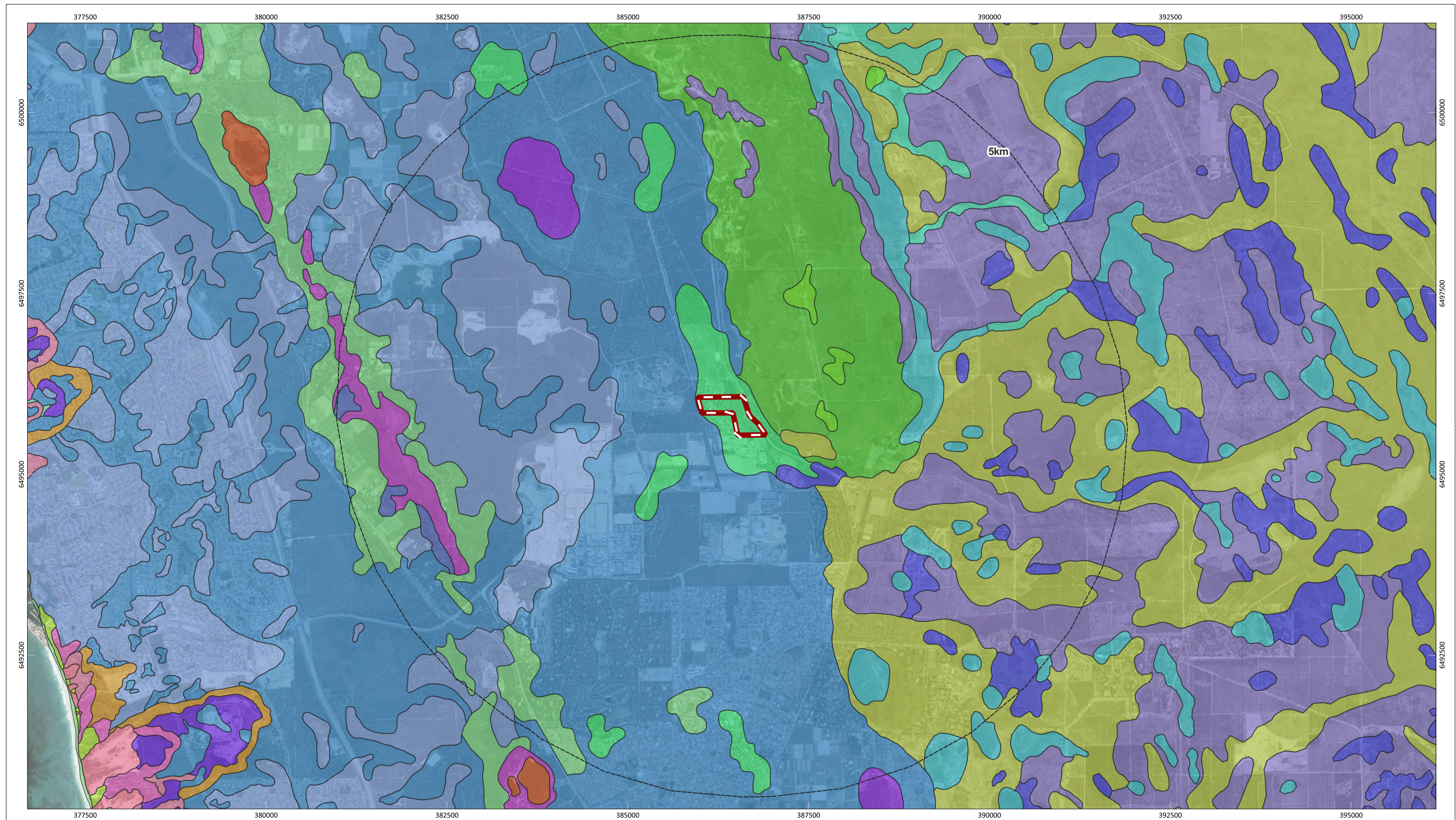
## 2.2 Interim Biogeographic Regionalisation for Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Commonwealth of Australia, 2012). The Survey Area is situated within the Swan Coastal Plain bioregion and the Swan Coastal Plain Perth (SWA02) subregion.

## 2.3 Geology and Soils

The geology units (DPIRD-027) intersecting the Survey Area as shown in Figure 2. The Survey Area is entirely within the Karrakatta Sand Grey Phase Mapping Unit (211Sp\_\_Kg). The Karrakatta Sand Grey Phase Mapping Unit is described as low hilly to gently undulating terrain with iron podzols. Vegetation associated with the mapping unit is *Banksia spp* woodland with *E. tottiana* and depauperate *E. marginata* with a dense shrub layer.







---

## 2.4 Pre-European Vegetation Types

### 2.4.1 Vegetation Association Mapping

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia. Beard (1981) mapped the vegetation of the SCP at 1:1,000,00 scale. This mapping described one broad vegetation unit; Spearwood Woodland for the Survey Area.

Beard's mapping attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps are maintained in digital form by DPIRD (2019). Extents are updated periodically by Department of Biodiversity, Conservation and Attractions (DBCA) (Government of Western Australia [GoWa], 2018).

### 2.4.2 Vegetation Complex Mapping

The vegetation complexes of the SCP were mapped by Heddle et al. (1980) at a scale of 1:250,000. According to this data, the Survey Area is primarily representative of two vegetation complex (see Figure 3):

- Karrakatta Complex-Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River.
- Pinjar Complex; Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species to a fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca preissiana* (Moonah) and sedgelands.



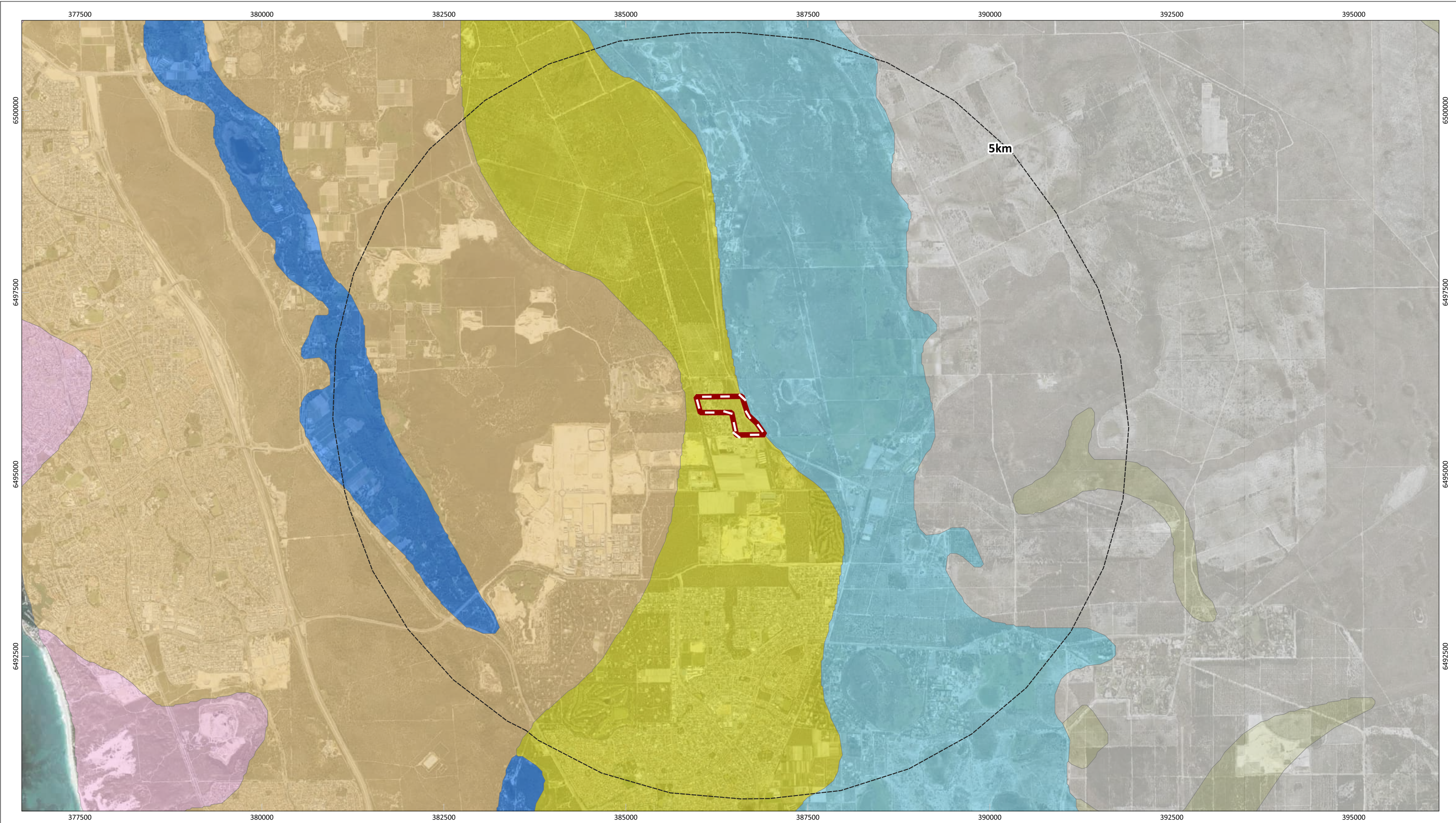


Figure 3: Vegetation Complexes Intersecting the Survey Area (DBCA-046)

0

700

1,400

2,100

2,800 m

N

SCALE

1:50,000

SHEET SIZE

A3 COLOUR

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DRAWN BY / REVIEWED BY

JP/JR

DATE

15/4/2025

Legend

Survey Area

Vegetation Complexes - Swan Coastal Plain (DBCA-046)

Bassendean Complex-North

Bassendean Complex-North Transition

Karrakatta Complex-Central and South

Cottesloe Complex-Central and South

Herdsman Complex

Pinjar Complex

Quindalup Complex

| No | Description    | Drawn | Approved | Date      |
|----|----------------|-------|----------|-----------|
| A  | Original Issue | JP    | JR       | 15/4/2025 |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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## 2.5 Environmentally Sensitive Areas, Conservation Estate and Bush Forever

Environmentally Sensitive Areas (ESAs) are declared by DWER to prevent the degradation of important environmental values such as Threatened Flora, Threatened Ecological Communities (TECs) or significant wetlands.

Conservation Estate are declared by DBCA to manage and protect important conservation values.

Bushland Policy for the Perth Metropolitan Region aims to provide a policy and implementation framework that ensures bushland protection and management issues throughout the Perth Metropolitan Region are adequately addressed and integrated with broader land use planning and decision-making (WAPC 2021). The policy predominantly deals with two distinct subjects, Bush Forever areas and local bushland areas.

The Survey Area intersects one ESA (DWER-046). This ESA is the 50 metre (m) buffer of a conservation listed wetland (DBCA-019) (see Figure 4 below).

The Survey Area does not intersect any Bush Forever Areas (DPLH-019) or other sites in the Conservation Estate, however the Survey Area is immediately adjacent to two Bush Forever Areas (see Table 2).

**Table 2 Bush Forever Areas adjacent to the Survey Area**

| Bush Forever ID | Bush Forever Name                                                                  |
|-----------------|------------------------------------------------------------------------------------|
| 428             | State Forest 65 - Pinjar Plantation South Bushland (10) Nowergup/ Yanchep/Neerabup |
| 382             | Lake Pinjar and Adjacent Bushland, Pinjar                                          |

## 2.6 Wetlands and Hydrology

The Survey Area intersects the very edge of a Conservation listed Sumpland Lake Pinjar (UID 13373) on its eastern edge (DBCA-019), as shown in Figure 5.

No Ramsar Site intersects the Survey Area. The Survey Area does not intersect with any wetlands listed under the Directory of Important Wetlands in Australia (DBCA-045) or any drainage lines (DWER-031).



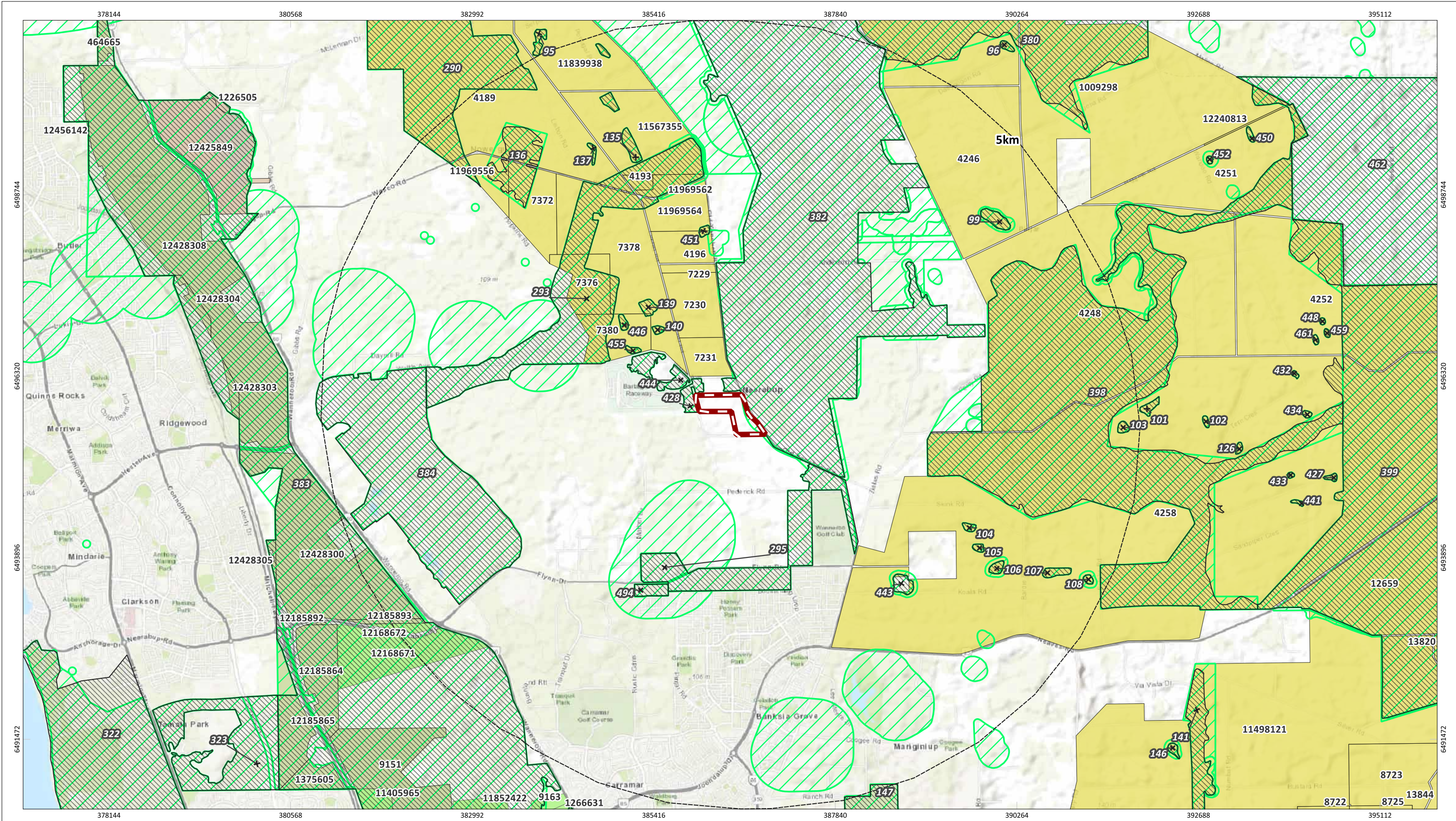


Figure 4: Environmentally Sensitive Areas, Conservation Estate and Bush Forever

0

700

1,400

2,100

2,800 m

1:48,475

A3 COLOUR

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DRAWN BY / REVIEWED BY

JP/JR

DATE

15/4/2025

Legend

Survey Area

Bush Forever Areas - 2000 (DPLH-019)

Clearing Regulations - Environmentally Sensitive Areas (DWER-046)

DBCA - Legislated Lands and Waters (DBCA-011)

National Park

Nature Reserve

State Forest

Crown Freehold - Dept Managed

No

Description

Drawn

Approved

Date

A

Original Issue

JP

JR

15/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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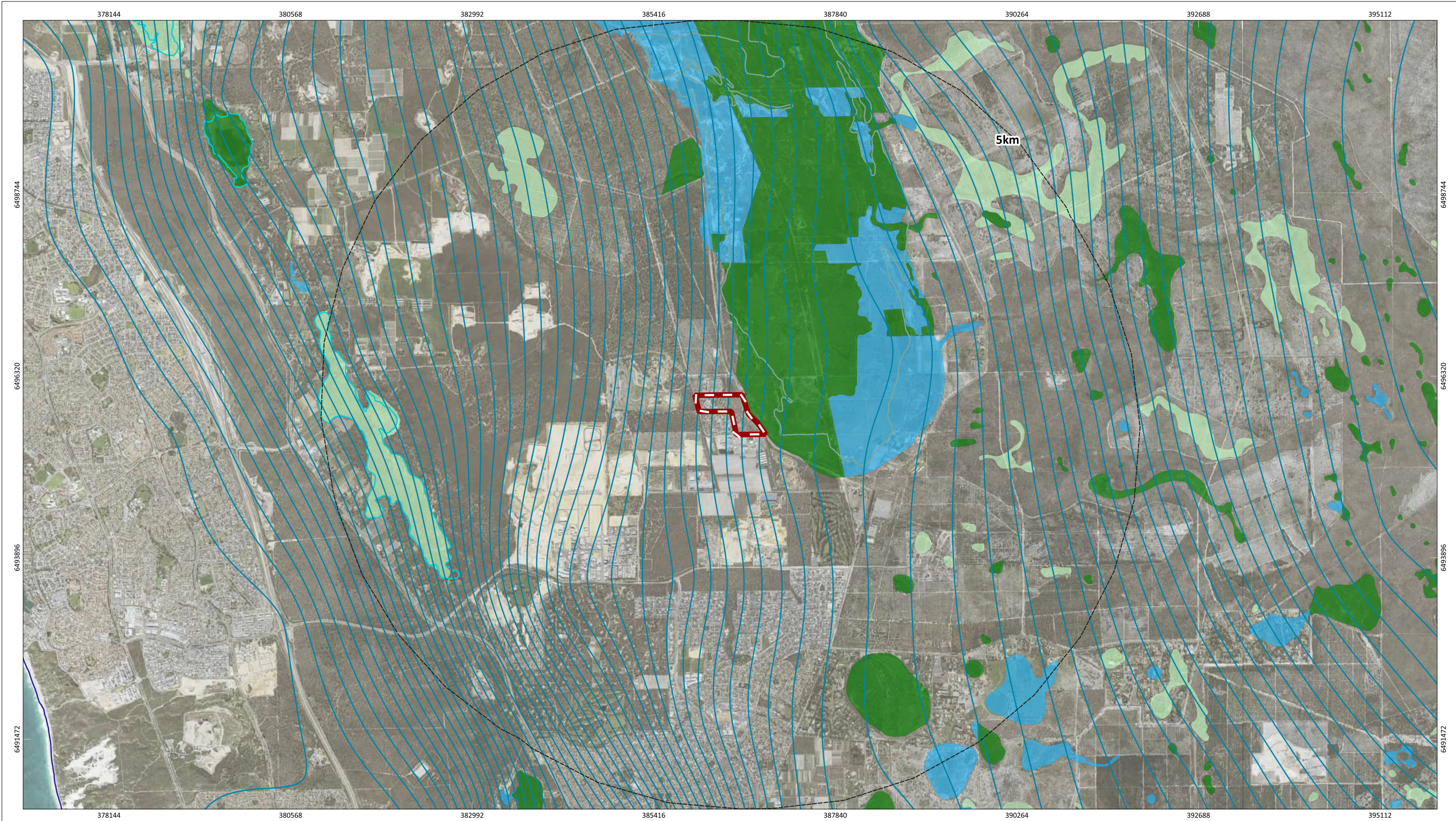


Figure 5: Surface Water Features and Geomorphic Wetlands

0

700

1,400

2,100

2,800 m

1:48,475

SHEET SIZE  
A3 COLOUR

PROJECT/REPORT NAME  
Basic Fauna and Targeted Black Cockatoo Habitat Assessment  
Wanneroo

CLIENT  
City of Wanneroo

PROJECT NUMBER  
A25.002

VERSION  
0

DRAWN BY / REVIEWED BY  
JP/JR

DATE  
15/4/2025

Legend

Survey Area

Gnangara Jandakot Water Table Elevation  
(Contours) – 2019 Max (DWER-100)

Hydrography Linear (Hierarchy) (DWER-031)

Coastal Waterline

Significant Stream

Major Tributary

Geomorphic Wetlands Swan Coastal Plain  
(DBCA-019)

Conservation

Multiple Use

Resource Enhancement

No

Description

Drawn

Approved

Date

A

Original Issue

JP

JR

15/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022.  
Label corresponds to the vegetation association  
number.

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ENVIRONMENTAL

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## 3. Methodology

### 3.1 Desktop Assessment

#### 3.1.1 Database Searches

Database searches of DBCA records were undertaken to compile a list of potential conservation significant fauna previously recorded within or surrounding the Survey Areas (see Table 3). In addition, an EPBC Protected Matters Search Tool (PMST) search was undertaken to identify the potential for Matters of National Environmental Significance (MNES) to occur within or surrounding the Survey Areas (DCCEEW, 2024).

**Table 3: Database Searches of the Survey Areas**

| Database Name                                                   | Date Received and Reference Number | Search Type                                             | Search Area                          |
|-----------------------------------------------------------------|------------------------------------|---------------------------------------------------------|--------------------------------------|
| DBCA Threatened and Priority Fauna database search (DBCA, 2025) | 13/02/2025<br>11-0225FA.           | Threatened and Priority Fauna                           | 10 km buffer around the Survey Areas |
| Protected Matters Search Tool (DCCEEW, 2025)                    | 13/03/2025<br>.                    | Commonwealth listed Threatened Flora and fauna and TECs | 10 km buffer around the Survey Areas |

#### 3.1.2 Likelihood of Occurrence

Conservation listed fauna identified from the desktop assessment were assessed to determine their likelihood of their occurrence within the Survey Area. The assessment was completed based on the likelihood of occurrence criteria presented in Table 4.

Only species either recorded within the Survey Area or considered as having a high or medium likelihood of occurrence in post field survey assessment will be discussed in detail. Species classified as having a low likelihood of occurrence will not be discussed unless a justification for this classification is required.

Species listed as Marine (MA) only under the EPBC Act (e.g. sharks, whales, turtles) and pelagic seabirds have been excluded from the likelihood of occurrence list as there is no marine habitat present within the Survey Area.

**Table 4: Likelihood of Occurrence Criteria**

| Likelihood | Criteria                                                                                            |
|------------|-----------------------------------------------------------------------------------------------------|
| Recorded   | Recorded in the Survey Area from database searches, previous survey by others or by current survey. |
| High       | Records of fauna species <10 km from the Survey Area. With record <20 years old; or                 |



| Likelihood | Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | <p>For species with well understood and specific habitat preference/ requirements, when specific habitat is present in the Survey Area, and records present &lt;10 km from the Survey Area.</p> <p>Species with general habitat preference, which is present in the Survey Area, and records present &lt;5 km from the Survey Area.</p>                                                                                                                                                                                                                              |
| Medium     | <p>There are records &lt;10 km from the Survey Area, however:</p> <p>The species is strongly linked to a specific habitat, which is marginally suitable or small in extent in the Survey Area; or</p> <p>Species has a general habitat preference, but small extent of suitable habitat is present.</p> <p>There is suitable habitat in the Survey Area, but records are &gt;10 km from Survey Area.</p>                                                                                                                                                             |
| Low        | <p>Records are historical only or are pre mapping procedures (e.g. records assigned to towns or place names).</p> <p>The species has a well understood and specific habitat preference/ requirements, which is absent from the Survey Area; or</p> <p>Suitable habitat is present, however there are no existing records of the species from the region despite reasonable previous search effort; or</p> <p>There is some suitable habitat in the Survey Area, however the species is very infrequently recorded in the locality (e.g. migratory bird species).</p> |

## 3.2 Basic Fauna Survey

The basic fauna survey incorporated a number of survey techniques as per the *Fauna Survey Technical Guidance* (EPA, 2020). A basic survey is a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information. The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats, with a focus on habitat for conservation listed fauna.

Fauna species were identified by active searches, secondary evidence such as scats, tracks, calls, remains, diggings and other signs. A fauna inventory was not compiled as part of this survey (not required under basic level survey) however observations are used to inform the fauna habitat type assessment. Potential habitats for conservation listed species were identified and evaluated and their likelihood of occurrence assessed.

The fauna survey was undertaken over two consecutive days: the 15th and 16th of July 2025. Details of the field survey team are presented below in Table 5.

**Table 5: Survey Team**

| Name        | Position and years of Experience |
|-------------|----------------------------------|
| Jack Rogers | Environmental Scientist, 4years  |

### 3.2.1 Fauna Habitat Type Assessment

The fauna habitat types present within the Survey Area were defined considering landform, vegetation, structure such as rockpiles and logs and fauna assemblage occupying the area.

---

The following information was used to define and map all fauna habitat types within the Survey Area at specific fauna habitat assessment points and during traverses of the Survey Area.

- Land systems and landform.
- Vegetation type and condition mapping.
- Soil characteristics.
- Structure such as rockpiles and logs.
- Fauna assemblage information from desktop assessment and field observations.
- Aerial imagery and historic imagery.

### 3.2.2 Fauna Taxonomy

Terrestrial vertebrate fauna taxa were identified in the field by an experienced ecologist.

Taxonomy and nomenclature follow the WA Museum checklist 2024 (Western Australian Museum, 2024). Conservation status follows the DBCA Threatened and Priority fauna list (DBCA, 2024). Where required verification of identification of secondary evidence (tracks, scats, diggings) may be undertaken by a relevant species group expert.

An inventory of all vertebrate species accurately identified by the field team within the Survey Area is presented in Appendix F.

## 3.3 Black cockatoo Habitat Assessment

The Survey Area falls within the modelled distribution and breeding range of the Carnaby's black cockatoo (*Zanda latirostris*) and forest red-tailed black cockatoo (*Calyptorhynchus banksii*) and outside the modelled breeding distribution of the Baudin's black cockatoo (*Zanda baudinii*), the Survey Area is however within the expected foraging range for Baudin's black cockatoo. (DCCEEW, 2022).

The SCP is utilised by Carnaby's black cockatoos for foraging, with some patches of breeding habitat. Vegetation used by Carnaby's is dominated by *Banksia* spp. and Tuart (*Eucalyptus gomphocephala*) woodlands, as well as Marri (*Corymbia calophylla*), with Jarrah (*E. marginata*) in the east. (DCCEEW, 2022).

Carnaby's black cockatoo and forest red-tailed black cockatoo breeding is unlikely to have started in July (Breeding usually occurs from August until November), so any potential nesting hollows wouldn't likely be unoccupied.

In the SCP, Carnaby's are present at any time of year, most commonly from January through to July, some individuals being present all year round. The timing of the survey in July provided good opportunity to record

foraging individuals. If no individuals are present, searching for foraging evidence is a reliable alternative as it will generally persist in the landscape (particularly chewed marri nut) (DCCEEW, 2022).

The black cockatoo habitat field survey followed the Commonwealth referral guidelines for Threatened black cockatoos (DCCEEW, 2022) for identifying breeding, foraging and roosting habitat.

### 3.3.1 Breeding Habitat Assessment

The Commonwealth defines breeding habitat as that which contains known, suitable or potential nesting trees, and which occurs within the range of the species. Terminology used in this report for breeding habitat trees follows that defined in glossary of DCCEEW (2022) as shown in Table 6

**Table 6: Breeding Habitat Terminology**

| Breeding Habitat Term                 | Definition (DCCEEW, 2022)                                                                                                                                                                                                            |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Known nesting trees</b>            | Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers). |
| <b>Suitable nesting trees</b>         | Trees with suitable nesting hollows present, although no evidence of use.                                                                                                                                                            |
| <b>Suitable nesting hollows</b>       | Any hollow with dimensions suitable for use for nesting by black cockatoos.                                                                                                                                                          |
| <b>Potential nesting trees</b>        | Trees that have a suitable Diameter at Breast Height (DBH) to develop a nest hollow, but do not currently have hollows. For most species of trees, suitable nest hollows are only found in live trees with a DBH of at least 500 mm. |
| <b>Potential future nesting trees</b> | Trees suitable to develop a nest hollow in the future are 300-500 mm DBH.                                                                                                                                                            |

In addition to Commonwealth guidelines for assessing breeding habitat trees, a scoring system based on that developed by Dr Mike Bamford (referred to as Bamford Class) was applied to class breeding habitat trees. This system and the Bamford Class alignment with DCCEEW (2022) breeding habitat terminology are shown in Table 7.

**Table 7: Black cockatoo Breeding Habitat Trees- Bamford Class**

| Bamford Class | Description of Tree and Hollows/Activity                                                                                                                                                                                                                     | Alignment with DAWE (2022) Breeding Habitat Terminology |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 1             | Active nest observed; adult (or immature) bird seen entering or emerging from hollow, eggs present.                                                                                                                                                          | Known nesting tree                                      |
| 2             | Hollow of suitable size and angle visible with chew marks attributed to black cockatoo nesting activity around entrance.                                                                                                                                     | Known nesting tree                                      |
| 3             | Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present if from ground-based assessment only (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10 m with thin rim). | Suitable nesting tree                                   |
| 4             | Tree with hollows or broken branches that might or do contain hollows, but hollows or potential hollows are not of a suitable size, or are aligned or obstructed so as to prevent access                                                                     | Potential nesting tree                                  |
| 5             | Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.                                                                                                                 | Potential nesting tree                                  |
| No Class      | No description. Potential future nesting trees were not considered in the Bamford Class scale.                                                                                                                                                               | Potential future nesting trees                          |

All breeding habitat trees were recorded using a mobile GIS field data collector platform. The following was recorded for each tree:

- Species.
- DBH (approximately 1.3 m from the ground).
- Coordinates.
- Presence of hollows (as observable from the ground).
- Bamford Class (see below).

Trees identified as potentially having suitable hollows present were inspected using a pole camera to determine the hollows internal dimensions. Hollow information recorded included:

- Size of entry.
- Estimated depth.
- Hollow type (knot, fissure, spout, vertical/chimney).



- 
- Suitability for use.
  - Evidence of use.
  - Presence of other birds or bees.

### 3.3.2 Foraging Habitat Assessment

The Commonwealth defines foraging habitat as areas including plants of species known to support foraging within the range of each black cockatoo species. Marri and jarrah woodlands are particularly important to forest red-tailed black cockatoo, while proteaceous heaths (shrublands dominated by *Banksia*, *Hakea* and *Grevillea* species) are also utilised by Carnaby's black cockatoo (DCCEEW, 2022).

The potential of the habitat within the Survey Area to support foraging was described, and any evidence was recorded, along with opportunistic sightings of any individual black cockatoos.

Habitat mapping of the Survey Area was used in conjunction with the site assessment to determine the foraging quality using the Foraging Habitat Scoring Tool (DCCEEW, 2022). The Foraging Habitat Scoring Tool (DCCEEW, 2022) is applied once only for an entire site. A secondary assessment was undertaken using the 'Habitat Scoring System for WA black cockatoo foraging habitat' (the Habitat Quality Scoring Tool) provided by DCCEEW in 2023 as an unpublished source. The Habitat Quality Scoring Tool produces a score of 0-7 for site condition and may be applied to each identified fauna habitat type. An overall site context score of 0-3 is then added. See Appendix E for detailed scoring tool methodologies.

As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (foraging condition low, negligible or none) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment.

### 3.3.3 Roosting Habitat Assessment

Roosting habitat was assessed based on observation of roosting or roosting evidence recorded during survey and based on habitat suitability (generally tall trees in the landscape in proximity to a water source). During the field survey, searches were conducted for evidence of roosting (e.g. piles of scats, feeding debris or chewed trees).

## 4. Results

### 4.1 Literature Review

A literature review was undertaken of previous terrestrial fauna studies considered relevant to the current Survey Area, to inform the targeted Black Cockatoo assessment and Basic Fauna Survey. A summary of the key findings relevant to the survey is provided below in Table 8.

**Table 8: Review of Previous Studies**

| Source- Title                                                                                                           | Key Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ecoscape (2021)</b><br><br><b>Neerabup Industrial Area - Environmental Assessment Report (Fauna)</b>                 | <p>The basic fauna survey undertaken in October 2020 of the area adjacent to the Survey Area recorded the following:</p> <ul style="list-style-type: none"> <li>• two fauna habitat types - Woodlands and Degraded Grasslands</li> <li>• 28 species detected during the basic survey</li> <li>• 226 previously recorded fauna species including 12 threatened and priority fauna species</li> <li>• three conservation listed species were recorded during the field survey, Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>), Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>), and Quenda (<i>Isoodon fusciventer</i>).</li> </ul>                                                           |
| <b>ATA Environmental (2007)</b><br><br><b>Neerabup Industrial Area Flora Vegetation And Vertebrate Fauna Assessment</b> | <p>Flora Vegetation and Vertebrate Fauna (Basi Fauna) Survey of the adjacent Neerabup Industrial Area (NIA)</p> <p>Two species (Carnaby's cockatoo and peregrine falcon) of conservation concern that are listed under the EPBC Act 1999 or the Wildlife Conservation Act 1950 were recorded during the survey. In addition, four other species of conservation concern (western brush wallaby, southern brush-tailed phascogale, black-striped snake, and southern brown bandicoot) have been recorded in the region in previous surveys. A ninth species (Chuditch) was known from the region but had not been recorded by ATA Environmental during this survey or previous surveys in similar habitat in the region.</p> |

### 4.2 Fauna Desktop Assessment

The database searches identified 31 conservation listed fauna species that potentially occur, or habitat likely occurs within the Survey Area, comprising:

- Twenty-three bird species.
- Five mammal species.
- One reptile species.
- Two invertebrate species.

The results of the DBCA Threatened and Priority Fauna database search are shown in Figure 6. Database searches results and desktop likelihood of occurrence assessment are summarised in Appendix C.

#### 4.2.1 Fauna Likelihood of Occurrence

The likelihood of occurrence for conservation listed fauna species found that:

- One conservation listed fauna species; *Zanda latirostris* (Carnaby's black cockatoo) Endangered (EN) was recorded as present.
- Three species had a high likelihood of occurrence.
- Two species had a medium likelihood of occurrence.
- Twenty-five species had a low likelihood of occurrence.

The results of the likelihood of occurrence assessment are presented in Appendix C.

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) EN
- *Isodon fusciventer* (Quenda, southwestern brown bandicoot) Priority 4 (P4)
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) Priority 3 (P3)

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) Other Specially Protected (OS)
- *Synemon gratiosa* (Graceful sun-moth) P4

The species assessed as low likelihood of occurrence are species that are locally extinct, have no recent records or for which no suitable habitat is present (e.g. wading birds). Species recorded or assessed as having a high or medium likelihood of occurrence are discussed in detail in Section 4.3.3.



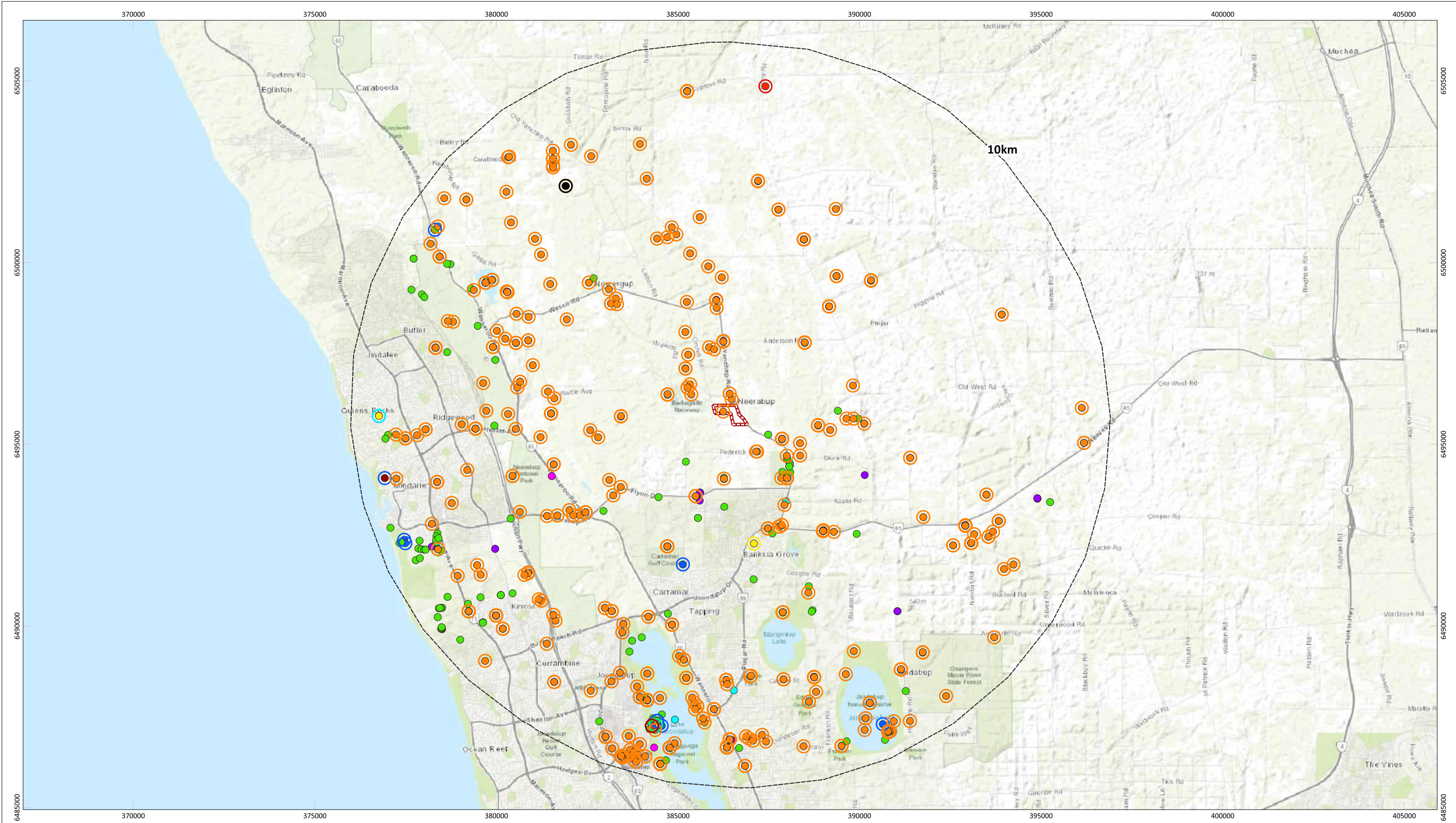


Figure 6: DBCA Database Search Results Fauna

0

1,500

3,000

4,500

6,000 m

N

SCALE

1:100,000

SHEET SIZE

A3 COLOUR

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DRAWN BY / REVIEWED BY

JP/JR

DATE

22/4/2025

Legend

Survey Area

DBCA Threatened and Priority Fauna (WA Status)

Extinct species

Conservation dependent and migratory species

Critically endangered species

Endangered species

Vulnerable species

Priority 2

Priority 3

Priority 4

Migratory species

Other specially protected species

DBCA Threatened and Priority Fauna (EPBC Status)

Extinct species

Critically endangered species

Critically endangered and migratory species

Endangered species

Endangered and migratory species

Vulnerable species

Vulnerable and migratory species

Migratory species

No

Description

Drawn

Approved

Date

A

Original issue

JP

JR

22/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd

08 6244 2310 | enquiries@western.com.au

Level 3/25 Prowse St, West Perth WA 6005

western.com.au

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## **4.3 Basic Fauna Field Survey**

### **4.3.1 Fauna Assemblage**

As per the scope of a basic fauna survey under the Technical Guidance the primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats, with a focus on habitat for conservation listed fauna.

### **4.3.2 Fauna Habitat Types**

Seven habitat types were described. The fauna habitat types are described below in Table 9 and shown in Figure 7.

For possibly occurring conservation listed fauna species, habitat types are assessed as either core, supporting or non-significant habitat. As per Commonwealth MNES – Significant Impact Guidelines 1.1 “core” habitat is defined as that critical to the survival of the species and considered to contain denning/ breeding sites, primary foraging areas and refuge from drought, fire and other stresses (DotE, 2013). “Supporting” habitat is defined as that which is likely used for foraging and dispersing/ connective purposes but is not essential habitat for the continuation of a local population. “Non-significant” habitat is that which would be used only very infrequently for foraging or dispersing. Discussion of habitat type suitability for species identified as having a high or medium likelihood of occurrence is provided in Table 9 and discussed in Section 4.2.3.

**Table 9: Fauna Habitat Type Descriptions within the Survey Area**

| Fauna Habitat Type                                 | Habitat Description                                                                                                                                                        | Total Area (ha), Proportion of the Survey Area (%) | Representative Photo                                                                |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>FHT-01 - Stands of small-fruited eucalyptus</b> | Native SCP species including <i>E. rudis</i> and <i>E. tottiana</i> . non-native planted Eucalyptus, over open paddock of short grassland offering minimal habitat values. |                                                    |  |
|                                                    | Not core habitat for listed species.                                                                                                                                       |                                                    |                                                                                     |
|                                                    | Supporting habitat for:<br>Carnaby's black cockatoo<br>Forest red-tailed black cockatoo<br>Quenda<br>Peregrine falcon                                                      | 1.52<br>6.53 %                                     |                                                                                     |
|                                                    | Non-significant habitat for:<br>Peregrine falcon<br>Black-striped snake<br>Graceful sun-moth                                                                               |                                                    |                                                                                     |

| Fauna Habitat Type               | Habitat Description                                                                                               | Total Area (ha), Proportion of the Survey Area (%) | Representative Photo                                                               |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------|
| FHT-02-<br>Individual<br>Banksia | Sparse <i>Banksia</i> spp. over weeds.                                                                            |                                                    |  |
|                                  | Not core habitat for listed species.                                                                              |                                                    |                                                                                    |
|                                  | Supporting habitat for:                                                                                           |                                                    |                                                                                    |
|                                  | Carnaby's black cockatoo                                                                                          | 0.06                                               |                                                                                    |
|                                  | Quenda                                                                                                            |                                                    |                                                                                    |
|                                  | Black-striped snake                                                                                               | 0.26 %                                             |                                                                                    |
|                                  | Graceful sun-moth                                                                                                 |                                                    |                                                                                    |
|                                  | Non-significant habitat for:                                                                                      |                                                    |                                                                                    |
|                                  | Forest red-tailed black cockatoo                                                                                  |                                                    |                                                                                    |
|                                  | Peregrine falcon                                                                                                  |                                                    |                                                                                    |
| FHT-03-<br>Nuytsia<br>grove      | Shrubland of native species ( <i>Jacksonia</i> spp) and weeds, dominated by <i>Nuytsia floribunda</i> over weeds. | 0.46                                               | Not photographed                                                                   |
|                                  | Not core habitat for listed species.                                                                              | 1.96 %                                             |                                                                                    |
|                                  | Supporting habitat for:                                                                                           |                                                    |                                                                                    |
|                                  | Quenda                                                                                                            |                                                    |                                                                                    |

| Fauna Habitat Type           | Habitat Description                                                                                                                                                                                                                                                                                                                    | Total Area (ha), Proportion of the Survey Area (%) | Representative Photo                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
|                              | Black-striped snake<br>Graceful sun-moth<br><br>Non-significant habitat for:<br>Carnaby's black cockatoo<br>Forest red-tailed black cockatoo<br>Peregrine falcon                                                                                                                                                                       |                                                    |                                                                                     |
| <b>FHT-04 - Sheoak grove</b> | Individual <i>Allocasuarina fraseriana</i> over small native shrubs and weeds<br><br>Not core habitat for listed species.<br><br>Supporting habitat for:<br>Forest red-tailed black cockatoo<br><br>Non-significant habitat for:<br>Carnaby's black cockatoo<br>Peregrine falcon<br>Quenda<br>Graceful sun-moth<br>Black-striped snake | 0.02<br><br><br><br><br>0.04 %                     |  |



| Fauna Habitat Type         | Habitat Description                                                                                                                                                                                                                                                                                                                                                            | Total Area (ha), Proportion of the Survey Area (%) | Representative Photo |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------------|
| FHT-05 - individual Jarrah | <p>Individual <i>Eucalyptus marginata</i> with a DBH greater than 30cm, over small native shrubs and weeds.</p> <p>Not core habitat for listed species.</p> <p>Supporting habitat for:<br/>Carnaby's black cockatoo<br/>Forest red-tailed black cockatoo</p> <p>Non-significant habitat for:<br/>Peregrine falcon<br/>Quenda<br/>Graceful sun-moth<br/>Black-striped snake</p> | Negligible                                         | Not photographed     |

| Fauna Habitat Type                          | Habitat Description                                                                                                                             | Total Area (ha), Proportion of the Survey Area (%) | Representative Photo                                                               |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------|
| BG-01- Bare ground, sand with sparse weeds. | Bare sandy ground and unvegetated sand, sparsely vegetated sand with occasional large <i>Melaleuca preissiana</i> , ground dominated by weeds.  |                                                    |  |
|                                             | Not core habitat for listed species.                                                                                                            |                                                    |                                                                                    |
|                                             | Supporting habitat for:<br>Black striped burrowing snake                                                                                        | 21.36                                              |                                                                                    |
|                                             | Non-significant habitat for:<br>Carnaby's black cockatoo<br>Forest red-tailed black cockatoo<br>Peregrine falcon<br>Quenda<br>Graceful sun-moth | 91.20 %                                            |                                                                                    |
| Total                                       |                                                                                                                                                 | 23.42                                              |                                                                                    |

Page redacted to protect sensitive species information.

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### 4.3.3 Threatened and Priority Fauna

Fauna species of conservation significance which were recorded as present or assessed as having a high or medium likelihood of occurrence (excluding black cockatoo species) are discussed in detail below.

Black cockatoo species were subject to a specific targeted habitat assessments which is presented in Section 4.3 below.

#### ***Black-striped snake, black-striped burrowing snake - P3***

Black-striped snake (*Neelaps calonotos*) is listed as a Priority 3 species by DBCA. The species inhabits coastal dunes and sandplains that support heath or banksia woodland.

As a subterranean sand dwelling nocturnal species, the majority of the Survey Area consists of supporting habitat for this species.

There is one DBCA records of this species within the 10 km buffer of the Survey Area within the last 20 years. This species is likely infrequently recorded due to its nocturnal and subterranean habit.

#### ***Peregrine falcon - OS***

Peregrine falcon (*Falco peregrinus*) is listed as a species in need of Other Specially Protected (OS), a cosmopolitan species that predates other bird species, it can be found in an extremely wide range of habitats. Habitats within the Survey Area have the potential to support a number of potential prey species, as well as perches that the Peregrine Falcon could use to prepare their prey. There is no breeding habitat present within the Survey Area for the Peregrine falcon, which require steep cliffs or built structures that serve as bio-mimics of their preferred cliffside nesting habitat.

There are six DBCA records of Peregrine falcons within 10 km of the Survey Area within the last 20 years. The species is likely to be only infrequently present, FHT-01 provides the only supporting habitat and other habitat types are considered non-significant habitat for the species.

#### ***Quenda, southwestern brown bandicoot - P4***

Quenda (*Isoodon fusciventer*) is listed as a Priority 4 species by DBCA. Preferred habitat for the species is dense understory such as around swamps or in banksia and jarrah woodlands. The DBCA database search returned 72 records of quenda within a radius of 10 km from the Survey Area within the last 20 years, FHT-01, 02 and 03 provide supporting habitat for this species.

#### ***Graceful sun-moth - P4***

Graceful sun-moth (*Synemon gratiosa*) is listed as is listed as a Priority 4 species by DBCA. Graceful sun-moth is associated with coastal heath land, dense and numerous vegetation and banksia woodland. The DBCA database search returned 20 records of graceful sun-moth within a radius of 10 km from the Survey Area within the last 20 years, FHT-02 and 03 provide supporting habitat for this species.



Graceful sun-moth require the host plant *Lomandra hermaphrodita* to complete their life cycle. *L. hermaphrodita* was not specifically surveyed for, however is common in banksia woodlands in the Wanneroo area; it was therefore assumed to be likely present. Graceful sun-moth has been given a precautionary Medium likelihood of occurrence

## 4.4 Black Cockatoo Habitat Assessment

### 4.4.1 Observations and Previous Records

The Survey Area falls within the modelled distribution and breeding range for Carnaby's black cockatoo and forest red-tailed black cockatoo and outside the modelled breeding and foraging range of Baudin's black cockatoo (DCCEEW, 2022). Carnaby's black cockatoo foraging evidence (chewed banksia cones) was identified as present within the Survey Area. Small flocks of Carnaby's cockatoos were observed commuting over the Survey Area on both days of the survey. No foraging evidence of forest red-tailed-Black cockatoo was observed within the Survey Area. There were no opportunistic sightings of forest red-tailed black cockatoo within the Survey Area.

There is a confirmed Carnaby's black cockatoo breeding location 7.5 km southwest of the Survey Area in the Edith Cowan University Campus at Lake Joondalup (DBCA database search). There are also two confirmed Carnaby's black cockatoo breeding locations approximately 20 km northwest and northeast respectively (DBCA-054) The Survey Area does not overlap with the (12 km) key foraging area buffer of these confirmed breeding locations. Seven mapped black cockatoo roosting sites are present within 6 km of the Survey Area (DBCA-064). All are confirmed Carnaby's black cockatoo roost sites (DBCA-064). See Figure 8.

### 4.4.2 Breeding Habitat Assessment

Breeding habitat is defined as that which contains known, suitable or potential nesting trees (DCCEEW, 2022). Breeding typically occurs in native eucalypt species particularly marri, karri, wandoo and tuart however many species of eucalypt including non-endemic species may develop suitable nesting hollows (DCCEEW, 2022). A summary of understood suitable nesting hollow characteristics for the three species is provided below in Table 10.

**Table 10: Black cockatoo Nesting Hollow Characteristics**

|                                        | Carnaby's black cockatoo                                                           | Forest red-tailed black cockatoo                                             |
|----------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Tree species and hollow characteristic | Nesting mainly in salmon gum, wandoo, tuart, jarrah, flooded gum, karri and marri. | Nesting mainly in jarrah, marri, karri, wandoo, bullich, blackbutt and tuart |
|                                        | Utilise hollows from 10-65 cm diameter (average 26 cm) and >1 m deep               | Utilise hollow from 12-150 cm diameter (average 34 cm) and >1 m depth        |
|                                        |                                                                                    | DCCEEW, 2022, Johnstone et al., 2013.                                        |

|  | Carnaby's black cockatoo                                      | Forest red-tailed black cockatoo |
|--|---------------------------------------------------------------|----------------------------------|
|  | DCCEEW, 2022, Saunders et al., 2014a, Saunders et al., 2014b. |                                  |

### Known and Suitable Nesting Trees

None of the 103 trees recorded within the Survey Area were identified as Known or Suitable nesting trees.

### Potential Nesting Trees

A total of 59 Potential breeding trees were recorded. See Figure 9 for tree locations and Appendix D for summary of tree locations, species and DBH. Trees within the Survey Area either showed no signs of potential nesting hollow development (Bamford class 5), or were Trees with hollows or broken branches that might or do contain hollows, but hollows or potential hollows are not of a suitable size or are aligned or obstructed so as to prevent access (Bamford class 4). A breakdown of tree results is presented in Table 11.

**Table 11 Summary of Black Cockatoo breeding Habitat Trees**

| Bamford Class                                                          | Class 1            | Class 2               | Class 3                | Class 4 or 5                   |                |     |
|------------------------------------------------------------------------|--------------------|-----------------------|------------------------|--------------------------------|----------------|-----|
| DAWE, 2022 Terminology                                                 | Known Nesting Tree | Suitable Nesting Tree | Potential Nesting Tree | Potential future nesting trees | Totals (Trees) |     |
| Tree Species                                                           |                    |                       |                        |                                |                |     |
| Coastal Blackbutt ( <i>Eucalyptus tottiana</i> )                       | -                  | -                     | -                      | 10                             | 18             | 28  |
| Small fruited Eucalypt ( <i>E. rudis</i> and <i>E. camaldulensis</i> ) | -                  | -                     | -                      | 45                             | 25             | 70  |
| Dead                                                                   | -                  | -                     | -                      | 4                              | 0              | 4   |
| Jarra                                                                  | -                  | -                     | -                      |                                | 1              | 1   |
| Total (Bamford Class                                                   | 0                  | 0                     | 0                      | 59                             | 44             | 103 |

### Potential Future Nesting Trees

A total of 44 trees had a DBH less than 50 cm and greater than 30 cm and were therefore classified as Potential future nesting trees.

#### 4.4.3 Foraging Habitat Assessment

The habitat within the survey area primarily comprised of large areas of open sand with sparse weeds and occasional native species and occasional large trees.

The eastern half of the Survey Area contains a number of large, poor condition or dead eucalypts which do not comprise important foraging resources for either species of black cockatoo, and large moonah trees (*Melaleuca preissiana*) which is not a foraging species for black cockatoo. Moonah were mapped under BG- 01 and are not represented separately in Figure 7. The western half of the Survey Area mostly comprised sparse groves of coastal blackbutt (*E. tottiana*) and Western Australian Christmas tree (*N. floribunda*), which also do not constitute important foraging resources for black cockatoo. Occasional stands of banksia (*B. attenuata* and *B. ilicifolia*) are present within the Survey Area and constitute good foraging habitat for Carnaby's black cockatoo, which was evidenced by instances of foraged banksia cones. The Survey Area contained occasional small groves of sheoak (*A. fraseriana*) which is a high value foraging species for forest red-tailed black cockatoo.

The Commonwealth referral guideline provides a foraging quality scoring tool to guide referral information (DCCEEW, 2022). The tool advises that if the Survey Area contains native vegetation used for foraging at any time by a black cockatoo species and is >1 ha in size, that it is considered at face value to be of very high quality and assigned a starting score of 10. The tool then allows for subtractions if attributes are present which reduce the functionality of the foraging habitat. The Commonwealth referral guidelines specify that the tool is to be applied once to the entire impact area even if there is more than one type of foraging habitat present. The calculated foraging habitat quality score is shown below in Table 12. Scores of 5-10 are identified as representing high value foraging habitat.

**Table 12: Foraging Quality Scoring Tool (DCCEEW, 2022)**

| Attribute                                                             | Carnaby's black cockatoo                                               | Forest red-tailed black cockatoo                                       |
|-----------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|
| Starting score                                                        | 10 - Foraging habitat more than 1 ha                                   | 10 - Foraging habitat more than 1 ha                                   |
| Foraging potential<br>(-2 if no foraging evidence)                    | Foraging evidence present                                              | -2 No foraging evidence present                                        |
| Connectivity<br>(-2 if no other foraging habitat in 12 km)            | No change, other foraging habitat <12 km away                          | No change, other foraging habitat <12 km away                          |
| Proximity to breeding habitat<br>(-2 if no breeding habitat in 12 km) | No change, recorded breeding habitat within 12 km                      | No change, recorded breeding habitat within 12 km                      |
| Proximity to roosting<br>(-1 if >20 km from known night roost)        | No change, known roosting site <20 km distant                          | No change, known roosting site <20 km distant                          |
| Impact from significant plant disease<br>(-1 if >50% impact)          | No change, impact from plant disease affecting <50% of foraging plants | No change, impact from plant disease affecting <50% of foraging plants |
| Total score                                                           | 10                                                                     | 8                                                                      |

The Commonwealth referral guidance allows for the inclusion of additional information for foraging habitat which may be considered during an assessment, such as the extent and density of recognised foraging plants within a Survey Area. As an additional source of information, WEPL provides an assessment of foraging habitat quality using a more detailed scoring tool developed by DCCEEW (n.d.) referred to as the Habitat Quality Scoring Tool to produce a numerical foraging habitat score. The Habitat Quality Scoring Tool allows for a score of 0 (none) to 7 (very high) for Site Condition. This is assessed based on density of known foraging species and health of vegetation. The 0-7 Site Condition score is applied to each mapped polygon of fauna habitat. The Habitat Quality Scoring Tool then applies a Site Context score out of three, this is applied only once to the whole Survey Area.

The Site Condition habitat quality score for each species, and the total area of that score present within the Survey Area are listed in Table 13 below and shown in Figure 10 and Figure 11 The score was calculated as per the criteria listed in Appendix E.

**Table 13: Habitat Quality Scoring Tool- Site Condition Extent**

| Site Condition      | Carnaby's black cockatoo (ha) | Forest red-tailed black cockatoo (ha) |
|---------------------|-------------------------------|---------------------------------------|
| 7- Very High        | -                             | --                                    |
| 6- High             | -                             | --                                    |
| 5-Moderate-High     | 0.06                          | -                                     |
| 4-Moderate          | -                             | 0.02                                  |
| 3-Low-Moderate      | -                             | -                                     |
| 2-Low               | 1.5                           | 1.5                                   |
| 1-Negligable to Low | 0.48                          | 0.52                                  |
| 0-None              | 21.36                         | 21.36                                 |
| <b>Total</b>        | <b>23.42</b>                  | <b>23.42</b>                          |

\* shaded cells are classified as not comprising suitable foraging habitat.

The Habitat Quality Scoring Tool then requires the application of a Site Context score out of three (see Table 14) which is added to the Site Condition score for a final x/10 score. See Table 15 for final Habitat Quality Scoring Tool score. Note that habitat with a Site Condition starting score of 2 or less are extremely unlikely to be suitable habitat and do not have a Site Context score added.



**Table 14: Habitat Quality Scoring Tool-Site Context**

| Site Context                                       |   |                                                      |    |                                                                                                |   |
|----------------------------------------------------|---|------------------------------------------------------|----|------------------------------------------------------------------------------------------------|---|
| Proximity of the site in relation to other habitat | 3 | Site is within 6 km of known breeding site.          | or | Site is within 12 km of other foraging resources with site condition of at least 3.            | 3 |
|                                                    | 2 | Site is within 12 km of known breeding site.         |    | Site is within 15 km of other foraging resources with site condition of at least 4.            | 2 |
|                                                    | 1 | Site is within 15 km of known breeding site.         |    | Site is between 15 km and 20 km of other foraging resources with site condition of at least 5. | 1 |
|                                                    | 0 | Site is further than 15 km from known breeding site. |    | Site is further than 20 km from other foraging resources.                                      | 0 |
| Totals                                             |   |                                                      |    |                                                                                                | 3 |

**Table 15: Final Habitat Quality Scoring Tool Score**

| Site Condition | Carnaby's black cockatoo (ha) | Forest red-tailed black cockatoo (ha) |
|----------------|-------------------------------|---------------------------------------|
| 10             | -                             | -                                     |
| 9              | -                             | -                                     |
| 8              | 0.06                          | -                                     |
| 7              | -                             | 0.02                                  |
| 6              | -                             | -                                     |
| 5              | -                             | -                                     |
| 4              | -                             | -                                     |
| 3              | -                             | -                                     |
| 2              | 1.5                           | 1.5                                   |
| 1              | 0.48                          | 0.52                                  |
| 0              | 21.36                         | 21.36                                 |
| Total          | 23.42                         | 23.42                                 |

\* shaded cells are classified as not comprising suitable foraging habitat.

As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (shaded cells) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment.

### Regional Foraging Habitat Assessment

Analysis of estimated foraging habitat extent within the local area was also undertaken to provide further context. The estimated extent of foraging habitat is calculated for a buffer of 12 km around and including the

Survey Area. This buffer is selected as recommended in the Commonwealth referral guidelines due to black cockatoos mainly foraging within 12 km of their nest site during the breeding season and their reliance on this proximity of foraging resources to successfully raise chicks (DCCEEW, 2022).

Analysis considers Remnant Native Vegetation Extent mapping (DPIRD-005) and Vegetation Complexes-Swan Coastal Plain and Southwest Forest region (DBCA-046 and DBCA-047). See summary of regional vegetation complexes and extents in Table 16 and displayed in Figure 12.

Analysis indicates there is 19450.5 ha of remnant native vegetation mapped within a 12 km buffer of the Survey Area. It is expected that the majority of this vegetation would contain suitable foraging species at the same or greater rate than that present within the Survey Area. Much of this regional remnant native vegetation occurs within the Gnaragarra State Forest and the Walyunga National Park.

Within the Survey Area there is 2.06 ha of foraging habitat scoring between 1 (negligible to low) and 7 (very high) on the Habitat Quality Scoring Tool -Site Condition scale. This represents 0.01 % of the estimated regional habitat extent. The habitat quality within the Survey Area is considered likely to be of similar quality than much of the regional foraging habitat, which includes the jarrah and marri forests of the Darling Scarp.

**Table 16: Regional Foraging Habitat Extent**

| Vegetation Complex                              | Remnant Extent (ha) |
|-------------------------------------------------|---------------------|
| Bassendean Complex-Central and South            | 19.37               |
| Bassendean Complex-Central and South Transition | 547.93              |
| Bassendean Complex-North                        | 7931.45             |
| Bassendean Complex-North Transition             | 852.44              |
| Cottesloe Complex-Central and South             | 4583.74             |
| Herdsmen Complex                                | 569.57              |
| Karrakatta Complex-Central and South            | 1041.55             |
| Karrakatta Complex-North                        | 480.30              |
| Karrakatta Complex-North Transition             | 1044.15             |
| Pinjar Complex                                  | 1751.82             |
| Quindalup Complex                               | 628.18              |
| Bassendean Complex-Central and South            | 19.37               |
| Bassendean Complex-Central and South Transition | 547.93              |
| Bassendean Complex-North                        | 7931.45             |
| <b>Total</b>                                    | <b>19450.5</b>      |

---

#### 4.4.4 Roosting Habitat Assessment

Three known roost sites are present <1 km from the Survey Areas (DBCA-064). No evidence of roosting within the Survey Area was recorded. There is a confirmed Carnaby's black cockatoo roosting Site on a residential property immediately south of the Survey Area, eight birds were recorded using the roosting area in 2017.

Night roosting locations are typically in proximity to foraging habitat (black cockatoos mainly foraging within 20 km of night roosts) and with access to water points <2 km from roosting location (DCCEEW, 2022). Any groups of tall trees, particularly large native eucalypts in proximity to water sources may provide night roosting habitat (DCCEEW, 2022). FHT-02 is considered to provide the most suitable roosting habitat. Throughout the Survey Area, isolated stands of tall (> 10 m) *Eucalyptus* are scattered which may provide suitable roosting habitat. Access to permanent water was present from Mariginiup Lake within 3 km.

Page redacted to protect sensitive species information.

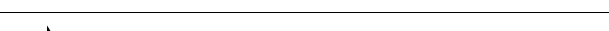








**Figure 10:** Carnaby's Black Cockatoo Foraging Habitat

|                                                                                    |  |                                                                                            |  |
|------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------|--|
|  |  | PROJECT/REPORT NAME<br>Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo |  |
| SCALE<br>1:3,061                                                                   |  | CLIENT<br>City of Wanneroo                                                                 |  |
| COORDINATE REFERENCE SYSTEM<br>GDA2020 / MGA zone 50                               |  | PROJECT NUMBER<br>A25.002                                                                  |  |
| DATA SOURCE<br>LANDGATE AERIAL IMAGERY NOW                                         |  | VERSION<br>0                                                                               |  |
|                                                                                    |  | DRAWN BY / REVIEWED BY<br>JP/JR                                                            |  |
|                                                                                    |  | DATE<br>22/4/2025                                                                          |  |

### Legend

 Survey Area

 Site Condition Score (Habitat Quality Score Tool)  
0

 1

 2

 5

| No | Description    | Drawn | Approved | Date      |
|----|----------------|-------|----------|-----------|
| A  | Original Issue | JP    | JR       | 22/4/2025 |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

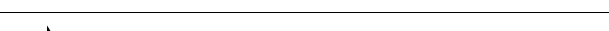


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**Figure 11:** Forest Red-Tailed Black Cockatoo Foraging Habitat

|                                                                                    |  |                                                                                            |  |
|------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------|--|
|  |  | PROJECT/REPORT NAME<br>Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo |  |
| SCALE<br>1:3,061                                                                   |  | CLIENT<br>City of Wanneroo                                                                 |  |
| COORDINATE REFERENCE SYSTEM<br>GDA2020 / MGA zone 50                               |  | PROJECT NUMBER<br>A25.002                                                                  |  |
| DATA SOURCE<br>LANDGATE AERIAL IMAGERY NOW                                         |  | VERSION<br>0                                                                               |  |
|                                                                                    |  | DRAWN BY / REVIEWED BY<br>JP/JR                                                            |  |
|                                                                                    |  | DATE<br>22/4/2025                                                                          |  |

### Legend

 Survey Area

 Site Condition Score (Habitat Quality Score Tool)

 0

 1

 2

 4

| No | Description    | Drawn | Approved | Date      |
|----|----------------|-------|----------|-----------|
| A  | Original Issue | JP    | JR       | 22/4/2025 |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |
|    |                |       |          |           |

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.



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## 5. Discussion

### 5.1 Basic Fauna Survey

Five fauna habitat types were described. The majority of the Survey Area consisted of sparsely vegetated sand. Occasional stands of *Eucalyptus*, *Banksia* and native shrubland were present within the Survey Area.

One species of Threatened or Priority fauna was recorded as present within the Survey Area was:

- *Zanda latirostris* (Carnaby's black cockatoo) EN

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) EN
- *Isoodon fusciventer* (Quenda, southwestern brown bandicoot) P4
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) P3

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) OS
- *Synemon gratiosa* (Graceful sun-moth) P4

Extent of core and supporting habitat present within the Survey Area by species is summarised in Table 17.

**Table 17: Summary of Habitat Values**

| Species                                                                       | Extent Core Habitat (ha) | Extent Supporting Habitat (ha) |
|-------------------------------------------------------------------------------|--------------------------|--------------------------------|
| <i>Zanda latirostris</i> (Carnaby's black cockatoo)                           | 0                        | 1.58                           |
| <i>Calyptorhynchus banksii</i> (forest red-tailed black cockatoo)             | 0                        | 1.54                           |
| <i>Isoodon fusciventer</i> (quenda)                                           | 0                        | 2.04                           |
| <i>Neelaps calonotos</i> (black-striped snake, black-striped burrowing snake) | 0                        | 21.88                          |
| <i>Falco peregrinus</i> (Peregrine falcon)                                    | 0                        | 1.52                           |
| <i>Synemon gratiosa</i> (graceful sun-moth)                                   | 0                        | 0.52                           |

---

## 5.2 Black Cockatoo Habitat Assessment

The Survey Area is within the modelled distribution for Carnaby's black cockatoo, and forest red-tailed black cockatoo. The Survey Area is outside of modelled breeding distribution for Baudin's black cockatoo and (DCCEEW, 2022).

No Potential or Known nesting trees were recorded within the Survey Area.

Fifty-nine Potential nesting trees were recorded within the Survey Area. Forty-four Potential future nesting trees were recorded within the Survey Area.

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (low, negligible or none value) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment. Foraging habitat was considered for Carnaby's black cockatoo, and forest red-tailed black cockatoo foraging habitat quality extents within the Survey Area out of ten are:

The Survey Area was assessed as containing 0.06 ha of suitable foraging habitat for Carnaby's black cockatoo and 0.02 ha of suitable foraging habitat for forest red-tailed black cockatoo.

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). Foraging habitat quality extents within the Survey Area out of ten are:

- Carnaby's black cockatoo: 0.06 ha (8/10), 1.93 ha (6/10), 1.5 ha (2/10), 0.48 ha (1/10), 21.36 ha (0/10). Total of 0.06 ha of suitable foraging habitat and 23.34 ha of unsuitable foraging habitat.
- Forest red-tailed black cockatoo: 0.02 ha (7/10), 1.5 ha (2/10), 0.52 ha (1/10), 21.36 ha (0/10). Total of 0.02 ha of suitable foraging habitat and 23.4 ha of unsuitable foraging habitat.

No evidence of roosting was recorded. Habitat types FHT-01 contains stands of tall trees which may provide suitable roosting habitat. Access to water is present in the nearby lake Joondalup and Lake Mariginiup.

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# Appendix A

## Legislation



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

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of Climate Change, Energy and the Environment lists Threatened species and communities in categories determined by criteria set out in the EPBC Act.

Projects likely to cause a significant impact on MNES should be referred to the DCCEEW for assessment under the EPBC Act.

### ***Biodiversity Conservation Act 2016***

The Biodiversity Conservation Act 2016 aims to conserve and protect biodiversity and biodiversity components within the State and to promote ecologically sustainable use of biodiversity components in the State.

### ***Environmental Protection Act 1986***

Declared Rare Flora (DRF) and Threatened Ecological Communities (TECs) are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Exemptions for a clearing permit do not apply in an ESA. In addition, habitat necessary for the maintenance of indigenous fauna is considered in the clearing principles and assessed during consideration of applications for a clearing permit.

### ***Department of Biodiversity, Conservation and Attractions Priority Lists***

DBCA lists 'Priority' flora and fauna that have not been assigned statutory protection as "Threatened" under the BC Act and are under consideration for declaration as Threatened. Flora and fauna assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora requires monitoring every 5 -10 years.

DBCA maintains a list of Priority Ecological Communities (PECs) which identifies plant communities that require further investigation before possible nomination for TEC status. Once listed, a community becomes a PEC and, when endorsed by the WA Minister for Environment, becomes a TEC and protected as an ESA under Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

### ***Informal Recognition of Flora and Fauna***

Certain populations or communities of flora and/or fauna may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora and may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, and changed fire regimes) and relict populations of such species assume local importance for DBCA. It is not uncommon for DBCA to make comment on these species of interest.

# **Appendix B**

## **Definitions and Criteria**

## EPBC Act Categories for Flora, Fauna and Ecological Communities

| Category                          | Threatened Species                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Threatened Ecological Communities                                                                                                                                                                                                                                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Extinct</b>                    | A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.                                                                                                                                                                                                                                                                                               | N/A.                                                                                                                                                                                                                                                                                                                                  |
| <b>Extinct in the wild</b>        | <p>A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time:</p> <p>(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or</p> <p>(b) it 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.</p> | N/A.                                                                                                                                                                                                                                                                                                                                  |
| <b>Critically Endangered (CE)</b> | A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                           | An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.                                                      |
| <b>Endangered (EN)</b>            | <p>A native species is eligible to be included in the endangered category at a particular time if, at that time:</p> <p>(a) it is not critically endangered; and</p> <p>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>                                                                                                                                                               | <p>An ecological community is eligible to be included in the endangered category at a particular time if, at that time:</p> <p>(a) it is not critically endangered; and</p> <p>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>          |
| <b>Vulnerable (VU)</b>            | <p>A native species is eligible to be included in the vulnerable category at a particular time if, at that time:</p> <p>(a) it is not critically endangered or endangered; and</p> <p>(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.</p>                                                                                                                                               | <p>An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time:</p> <p>(a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.</p> |
| <b>Conservation Dependent</b>     | <p>A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:</p> <p>(a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or</p> <p>(b) the following subparagraphs are satisfied:</p>                                                                                                       | N/A.                                                                                                                                                                                                                                                                                                                                  |

| Category | Threatened Species                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Threatened Ecological Communities |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|          | <p>(i) the species is a species of fish.</p> <p>(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised.</p> <p>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory.</p> <p>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</p> |                                   |

## Conservation Codes for Western Australian Flora and Fauna (DBCA)

| Conservation Codes for Western Australian Flora and Fauna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Threatened, Extinct and Specially Protected fauna or flora which have been adequately searched for and are deemed to be, in the wild, Threatened, extinct or in need of special protection, and have been gazetted as such. The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016.</b></p> <p><b>Categories of Threatened, Extinct and Specially Protected fauna and flora are:</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>T</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>Threatened species</b></p> <p>Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as Threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).</p> <p>Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.</p> <p>Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using International Union for Conservation of Nature (IUCN) Red List categories and criteria as detailed below.</p> |
| <b>CR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Critically endangered species</b></p> <p>Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.</p>                                                                                                                                                                                                                                                                                                       |
| <b>EN</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Endangered species</b></p> <p>Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



## Conservation Codes for Western Australian Flora and Fauna

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VU | <p>Vulnerable species</p> <p>Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.</p> |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EX | <p>Extinct species</p> <p>Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.</p> |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EW | <p>Extinct in the wild species</p> <p>Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>Currently there are no Threatened fauna or Threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p> |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MI | <p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p> |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Conservation Codes for Western Australian Flora and Fauna

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CD | <p>Species of special conservation interest (conservation dependent fauna)</p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).</p> <p>Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p> |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|    |                                                                                                                                                                                                                                                                                                                                                                           |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OS | <p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p> <p>Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p> |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P | <p>Priority species</p> <p>Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of Priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora.</p> <p>Species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened, or that have been recently removed from the Threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p> |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>Priority 1: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p> |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | <p>Priority 2: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p> |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | <p>Priority 3: Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey</p> |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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#### Conservation Codes for Western Australian Flora and Fauna

requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4

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

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

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

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

# **Appendix C**

## **Desktop Assessment Results and Likelihood of Occurrence Assessment**



### Fauna Database Search Results (DBCA Database Search using 20 Km Buffer, PMST 20 km buffer), Likelihood and Fauna Survey Records

| Scientific Name                     | Common Name                            | Conservation Status |         | Database Source |      | Likelihood of Occurrence | Justification                                                                                          |
|-------------------------------------|----------------------------------------|---------------------|---------|-----------------|------|--------------------------|--------------------------------------------------------------------------------------------------------|
|                                     |                                        | WA                  | EPBC    | DBCA            | PMST |                          |                                                                                                        |
| Aves                                |                                        |                     |         |                 |      |                          |                                                                                                        |
| <i>Apus pacificus</i>               | fork-tailed swift                      | MI                  | MI      | X               | X    | Low                      | Migratory species, no breeding or roosting habitat within Survey Area                                  |
| <i>Botaurus poiciloptilus</i>       | Australasian Bittern                   | EN                  | EN      | X               | X    | Low                      | Wetland species, no suitable habitat within Survey Area                                                |
| <i>Calidris acuminata</i>           | Sharp-tailed Sandpiper                 | MI                  | VU & MI | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area                                              |
| <i>Calidris canutus</i>             | Red Knot, Knot                         | EN                  | VU & MI | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area                                              |
| <i>Calidris ferruginea</i>          | Curlew Sandpiper                       | CR                  | CR & MI | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area                                              |
| <i>Calidris ruficollis</i>          | red-necked stint                       | MI                  | MI      | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area                                              |
| <i>Calyptorhynchus banksii naso</i> | forest red-tailed black cockatoo       | VU                  | VU      | X               | X    | High                     | Potential foraging habitat within and adjacent to Survey Area. 2 records within 10 km within 20 years. |
| <i>Charadrius leschenaultii</i>     | greater sand plover, large sand plover | VU                  | VU & MI | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area                                              |
| <i>Falco peregrinus</i>             | peregrine falcon                       | OS                  |         | X               |      | Medium                   | Flyover species, may alight in tall trees to consume avian prey.                                       |
| <i>Leipoa ocellata</i>              | Malleefowl                             | VU                  | VU      | X               | X    | Low                      | Locally extinct                                                                                        |

| Scientific Name                   | Common Name                                                     | Conservation Status |         | Database Source |      | Likelihood of Occurrence | Justification                                                       |
|-----------------------------------|-----------------------------------------------------------------|---------------------|---------|-----------------|------|--------------------------|---------------------------------------------------------------------|
|                                   |                                                                 | WA                  | EPBC    | DBCA            | PMST |                          |                                                                     |
| <i>Limosa lapponica menzbieri</i> | Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit | CR                  | EN      | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area           |
| <i>Limosa limosa</i>              | black-tailed godwit                                             | MI                  | MI      | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area           |
| <i>Numenius madagascariensis</i>  | Eastern Curlew, Far Eastern Curlew                              | CR                  | CR & MI | X               | X    | Low                      | Migratory shorebird, unlikely to occur within Survey Area           |
| <i>Oxyura australis</i>           | blue-billed duck                                                | P4                  |         | X               |      | Low                      | Wetland species, no suitable habitat within Survey Area             |
| <i>Pandion haliaetus</i>          | osprey                                                          | MI                  | MI      | X               | X    | Low                      | Coastal species, no suitable habitat within Survey Area             |
| <i>Plegadis falcinellus</i>       | glossy ibis                                                     | MI                  | MI      | X               | X    | Low                      | Wetland species, no suitable habitat within Survey Area             |
| <i>Rostratula australis</i>       | Australian Painted Snipe                                        | EN                  | EN      | X               | X    | Low                      | Wetland species, no suitable habitat within Survey Area             |
| <i>Sternula albifrons</i>         | Little Tern                                                     | MI                  | MI      | X               | X    | Low                      | Coastal and wetland species, no suitable habitat within Survey Area |
| <i>Sternula nereis nereis</i>     | Australian Fairy Tern                                           | VU                  | VU      | X               | X    | Low                      | Coastal and wetland species, no suitable habitat within Survey Area |
| <i>Thalasseus bergii</i>          | crested tern                                                    | MI                  | MI      | X               | X    | Low                      | Coastal and wetland species, no suitable habitat within Survey Area |
| <i>Tringa nebularia</i>           | common greenshank                                               | MI                  | MI      | X               | X    | Low                      | Wetland species, no suitable habitat within Survey Area             |

| Scientific Name                | Common Name                                        | Conservation Status |      | Database Source |      | Likelihood of Occurrence | Justification                                                                                                                             |
|--------------------------------|----------------------------------------------------|---------------------|------|-----------------|------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|                                |                                                    | WA                  | EPBC | DBCA            | PMST |                          |                                                                                                                                           |
| <i>Zanda baudinii</i>          | Baudin's cockatoo                                  | EN                  | EN   | X               | X    | Low                      | Outside of expected presence range for species                                                                                            |
| <i>Zanda latirostris</i>       | Carnaby's cockatoo                                 | EN                  | EN   | X               | X    | Recorded                 | Observed flying over Survey Area, Recorded in DBCA data. 413 DBCA records within 10 km within 20 years.                                   |
| <b>Mammals</b>                 |                                                    |                     |      |                 |      |                          |                                                                                                                                           |
| <i>Dasyurus geoffroii</i>      | Chuditch, Western Quoll                            | VU                  |      |                 |      | Low                      | Locally extinct                                                                                                                           |
| <i>Hydromys chrysogaster</i>   | water-rat, rakali                                  | P4                  |      | X               |      | Low                      | Wetland species, no suitable habitat within or near Survey Area.                                                                          |
| <i>Isodon fusciventer</i>      | quenda, southwestern brown bandicoot               | P4                  |      | X               |      | High                     | Suitable vegetated habitats within the Survey Area. 72 records within 10 km within 20 years.                                              |
| <i>Macroderma gigas</i>        | Ghost Bat                                          |                     | VU   | X               | X    | Low                      | PMST record, very far outside of expected range.                                                                                          |
| <i>Notamacropus irma</i>       | western brush wallaby                              | P4                  |      | X               |      | Low                      | Primary habitat for species not present within Survey Area. 2 records within 10 km within 20 years                                        |
| <b>Reptiles and Amphibians</b> |                                                    |                     |      |                 |      |                          |                                                                                                                                           |
| <i>Neelaps calonotos</i>       | black-striped snake, black-striped burrowing snake | P3                  |      | X               |      | High                     | Subterranean sandplain species, which is likely under recorded, one record within 10 km in 20 years. Entire Site constitutes Core habitat |
| <b>Invertebrates</b>           |                                                    |                     |      |                 |      |                          |                                                                                                                                           |

| Scientific Name                 | Common Name                | Conservation Status |      | Database Source |      | Likelihood of Occurrence | Justification                                                                                                                              |
|---------------------------------|----------------------------|---------------------|------|-----------------|------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |                            | WA                  | EPBC | DBCA            | PMST |                          |                                                                                                                                            |
| <i>Synemon gratiosa</i>         | graceful sun-moth          | P4                  |      | X               |      | Medium                   | 20 records within 10 km within 20 years. Host species <i>Lomandra hermaphrodita</i> not surveyed for but may be present within Survey Area |
| <i>Hesperocolletes douglasi</i> | Douglas's broad-headed bee | CR                  | CR   | X               |      | Low                      | Single record of species from Pinjar area in 2015, very unlikely to occur within Survey Area.                                              |



# **Appendix D**

## **Black Cockatoo Potential Suitable and Known Breeding Trees**

Pages redacted to protect sensitive species information.

# **Appendix E**

## **Black Cockatoo Habitat Quality Scoring Tool (DCCEEW, n.d)**

### Habitat Scoring System for WA black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat<sup>1</sup> for the three WA black cockatoo species (Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the 'detail' column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

| Indicator                                                   | Score | Detail         |                                                                                                                                                                             | Impact site | Offset start quality | Without offset | With offset |
|-------------------------------------------------------------|-------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------|----------------|-------------|
| Site Condition                                              |       |                |                                                                                                                                                                             |             |                      |                |             |
|                                                             |       | Foraging value | Details                                                                                                                                                                     |             |                      |                |             |
| Vegetation condition and structure.<br><br>Habitat features | 7     | Very High      | Carnaby’s Black Cockatoo                                                                                                                                                    |             |                      |                |             |
|                                                             |       |                | Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths². |             |                      |                |             |
|                                                             |       |                | Baudin’s Black Cockatoo                                                                                                                                                     |             |                      |                |             |
|                                                             |       |                | Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.                                                                  |             |                      |                |             |
|                                                             |       |                | Forest Red-tailed Black Cockatoo                                                                                                                                            |             |                      |                |             |
|                                                             |       |                | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.                   |             |                      |                |             |
|                                                             | 6     | High           | Carnaby’s Black Cockatoo                                                                                                                                                    |             |                      |                |             |
|                                                             |       |                | Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths. |             |                      |                |             |
|                                                             |       |                | Baudin’s Black Cockatoo                                                                                                                                                     |             |                      |                |             |
|                                                             |       |                | Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.                                                                 |             |                      |                |             |
|                                                             |       |                | Forest Red-tailed Black Cockatoo                                                                                                                                            |             |                      |                |             |
|                                                             |       |                | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.                  |             |                      |                |             |

<sup>1</sup> In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

<sup>2</sup>No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.



|                                                         |   |                  |                                                                                                                                                                                                                                    |  |  |  |  |
|---------------------------------------------------------|---|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| Vegetation condition and structure.<br>Habitat features | 5 | Moderate to high | Carnaby's Black Cockatoo                                                                                                                                                                                                           |  |  |  |  |
|                                                         |   |                  | Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%). |  |  |  |  |
|                                                         |   |                  | Baudin's Black Cockatoo                                                                                                                                                                                                            |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).                                                                  |  |  |  |  |
|                                                         |   |                  | Forest Red-tailed Black Cockatoo                                                                                                                                                                                                   |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).                  |  |  |  |  |
|                                                         | 4 | Moderate         | Carnaby's Black Cockatoo                                                                                                                                                                                                           |  |  |  |  |
|                                                         |   |                  | Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).                                                                                |  |  |  |  |
|                                                         |   |                  | Baudin's Black Cockatoo                                                                                                                                                                                                            |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).                               |  |  |  |  |
|                                                         |   |                  | Forest Red-tailed Black Cockatoo                                                                                                                                                                                                   |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).              |  |  |  |  |
|                                                         | 3 | Low to moderate  | Carnaby's Black Cockatoo                                                                                                                                                                                                           |  |  |  |  |
|                                                         |   |                  | Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.                                                                                                                             |  |  |  |  |
|                                                         |   |                  | Baudin's Black Cockatoo                                                                                                                                                                                                            |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.                                                                                                                                                               |  |  |  |  |
|                                                         |   |                  | Forest Red-tailed Black Cockatoo                                                                                                                                                                                                   |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.                                                                                                                |  |  |  |  |
|                                                         | 2 | Low              | Carnaby's Black Cockatoo                                                                                                                                                                                                           |  |  |  |  |
|                                                         |   |                  | Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.                                        |  |  |  |  |
|                                                         |   |                  | Baudin's Black Cockatoo                                                                                                                                                                                                            |  |  |  |  |
|                                                         |   |                  | Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.                                                                 |  |  |  |  |

|                                     |   |                   |                                                                                                                                                                                                                                                        |  |  |  |  |
|-------------------------------------|---|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| Vegetation condition and structure. |   |                   | Forest Red-tailed Black Cockatoo                                                                                                                                                                                                                       |  |  |  |  |
|                                     |   |                   | Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> . |  |  |  |  |
|                                     | 1 | Negligible to low | All species                                                                                                                                                                                                                                            |  |  |  |  |
|                                     |   |                   | Scattered specimens of known food plants but projected foliage cover of these is <2%. May include: paddocks or urban areas with scattered foraging trees.                                                                                              |  |  |  |  |
| Habitat features                    | 0 | None              | All species                                                                                                                                                                                                                                            |  |  |  |  |
|                                     |   |                   | No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).                                                                                |  |  |  |  |
|                                     |   |                   | Totals                                                                                                                                                                                                                                                 |  |  |  |  |

| Site Context                                        |   |                                                     |    |                                                                                              |  |  |  |
|-----------------------------------------------------|---|-----------------------------------------------------|----|----------------------------------------------------------------------------------------------|--|--|--|
| Proximity of the site in relation to other habitat. | 3 | Site is within 6km of known breeding site.          | or | Site is within 12km of other foraging resources with site condition of at least 3.           |  |  |  |
|                                                     | 2 | Site is within 12km of known breeding site.         | or | Site is within 15km of other foraging resources with site condition of at least 4.           |  |  |  |
|                                                     | 1 | Site is within 15km of known breeding site.         | or | Site is between 15km and 20km of other foraging resources with site condition of at least 5. |  |  |  |
|                                                     | 0 | Site is further than 15km from known breeding site. | or | Site is further than 20km from other foraging resources.                                     |  |  |  |
| Totals                                              |   |                                                     |    |                                                                                              |  |  |  |

|              |  |  |  |  |  |  |  |  |
|--------------|--|--|--|--|--|--|--|--|
| Final Totals |  |  |  |  |  |  |  |  |
|--------------|--|--|--|--|--|--|--|--|

| Indicator                            |     | Species Stocking Rate <sup>3</sup>                                                                                                                                                                                                                           | Impact Site |     |     | Offset Site |     |     |
|--------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----|-----|-------------|-----|-----|
|                                      |     |                                                                                                                                                                                                                                                              | CBC         | BBC | FRT | CBC         | BBC | FRT |
| Confirm presence/absence of species. | Yes | Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. |             |     |     |             |     |     |
|                                      | No  | Species is recorded or reported very infrequently and there is little or no foraging evidence.                                                                                                                                                               |             |     |     |             |     |     |

<sup>3</sup> Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

| Legend |                                                                                                                                                                                                                                                                      |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is <b>No</b> for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site. |

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.







# Targeted Black Cockatoo Habitat Survey



**Prepared for: City of Wanneroo**

**3 June 2026**

**Project Number: TW25008**

#### DOCUMENT CONTROL

| Version | Description  | Date       | Author | Reviewer | Approver |
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## Abbreviations and Acronyms

**Table 1: List of used Abbreviations and Acronyms**

| Abbreviation/Acronym |                                                                                |
|----------------------|--------------------------------------------------------------------------------|
| BCE                  | Bamford Consulting Ecologists                                                  |
| BC Act               | Biodiversity and Conservation Act 2016 (Western Australia)                     |
| CoW                  | City of Wanneroo                                                               |
| DAWE                 | Department of Agriculture, Water and the Environment                           |
| DBCA                 | Department of Biodiversity, Conservation and Attractions                       |
| DBH                  | Diameter at Breast Height                                                      |
| DCCEEW               | Department of Climate Change, Energy, the Environment and Water                |
| DWER                 | Department of Water and Environmental Regulation                               |
| EN                   | Endangered                                                                     |
| EP Act               | Environmental Protection Act 1986 (Western Australia)                          |
| EPA                  | Environmental Protection Authority                                             |
| EPBC Act             | Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) |
| GPS                  | Global Positioning System                                                      |
| ISA                  | Index of Surveys for Assessment                                                |
| SCP                  | Swan Coastal Plain                                                             |
| Talis                | Talis Consultants Pty Ltd                                                      |
| VU                   | Vulnerable                                                                     |
| WA                   | Western Australia                                                              |

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# 1 Introduction

## 1.1 Project Background

The City of Wanneroo (CoW) is advancing the development of the Neerabup Resource Recovery Precinct (NRRP) and has submitted a Native Vegetation Clearing Permit (NVCP) to conduct clearing for Stage 1. Talis Consultants Pty Ltd (Talis) is aiding the CoW with various aspects in regard to the NRRP one of them being the development, submission and approval of the NVCP.

The NVCP was originally submitted in March 2025, amended in July 2025, granted in January 2026 and appealed shortly thereafter. During the response to the Office of the Appeals Convenor and the discussions as to whether a requirement under the Federal *Environment Protection and Biodiversity Conservation Act 1999*, inconsistencies in the biological survey reports informing the NVCP application became apparent.

As such, further work was commissioned to identify these inconsistencies and how they should be considered.

## 1.2 Project Objectives

The objectives of this project are to:

- Undertake a targeted survey of Black Cockatoo breeding habitat, with a particular focus on identifying and assessing suitable nesting trees, in order to validate and, where necessary, refine the findings of previous surveys;
- Conduct a comprehensive comparison of all available survey datasets, clearly documenting any discrepancies, as well as outlining the key differences in methodology, survey effort, and associated limitations; and
- Provide informed, practical advice regarding the environmental approvals pathway, including relevant regulatory considerations and potential implications for the proposed activities.

### 1.2.1 Legislative Context

The project complied with the following Federal and State legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Biodiversity Conservation Act 2016* (BC Act); and
- *Environmental Protection Act 1986* (EP Act).

The project also complied with the following guidelines:

- *Technical Guidance Terrestrial Vertebrate Fauna Surveys for EIA* (Environmental Protection Authority (EPA), 2020);
- *Environmental Factor Guidelines Terrestrial Fauna* (EPA, 2016);
- *Referral Guidelines for 3 WA Threatened Black Cockatoo Species* (Department of Agriculture Water and the Environment (DAWE), 2022a);
- *Approach to the valuation of nesting habitat for Black Cockatoos* (Bamford Consulting Ecologists (BCE, 2025); and
- Procedure – Preparing data packages for the Index of surveys for Assessments (ISA) (Department of Water and Environmental Regulation (DWER), 2025).

## 1.3 Black Cockatoos

The survey area is situated within the distribution of two (Forest Red-tailed Black Cockatoo and Carnaby's Cockatoo) of the three conservation-listed Black Cockatoo species found in WA (DAWE, 2022). Both species are dependent on the availability of suitable foraging habitat, particularly mature native vegetation that provides key food resources such as Marri, Jarrah and Banksia species. Additionally, the presence of large, hollow-bearing trees is critical for breeding, as these cockatoos rely on hollows for nesting.

Given the conservation status of these species, any loss or degradation of habitat within the survey area may have a significant impact on local populations. As such, the protection and management of foraging and breeding habitat is an important consideration in assessing the ecological values of the site and potential impacts of proposed activities.

### 1.3.1 Previous Black Cockatoo Habitat Assessment

To support environmental approvals, the CoW commissioned biological surveys intersecting the currently proposed clearing area. Ecoscape (2021) and Western Environmental (2025) undertook Black Cockatoo habitat assessments and their findings in relation to the clearing area are summarised in Table 1-1.

**Table 1-1: Summary of Previous Survey Findings**

| Survey                       | Total Number of Trees identified | Trees with a DBH <sup>1</sup> > 50 cm | Trees with a DBH < 50 cm |
|------------------------------|----------------------------------|---------------------------------------|--------------------------|
| Ecoscape (2021)              | 3                                | 3                                     | -                        |
| Western Environmental (2025) | 30                               | 25                                    | 5                        |

There is a notable discrepancy in the total number of trees recorded within the clearing area between the two assessments, which may be attributed to differences in survey effort or methodology.

The Ecoscape assessment was completed in accordance with the *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species* (Department of Sustainability Environment Water Population and Communities, 2012) whereas the Western Environmental assessment applied the updated guidelines (DAWE, 2022). While different guidance documents were used, these differences do not appear to account for the variation in survey effort.

---

<sup>1</sup> Diameter of the tree measured at breast height (1.3 m)



## 2 Talis Methodology

### 2.1 Black Cockatoo Habitat Assessment

The field survey was conducted on the 29th of April 2026 by a Senior Ecologist , during which the proposed clearing area was systematically and thoroughly traversed on foot to ensure comprehensive coverage. Detailed information was recorded for each individual *Eucalyptus* tree encountered during the survey, including the following attributes:

- Unique identification number,
- Date sampled;
- GPS location;
- Photograph;
- DBH;
- Bamford Class (BCE, 2025 outlined in Table A-3 in Appendix A) if hollows were present (hollows were assessed from ground level only);
- Evidence of use such as foraging and/or nesting; and
- Any additional notes (i.e. presence of other birds' nests, bees, etc.).

## 3 Results

### 3.1 Potential Black Cockatoo Breeding Habitat

The survey area was systematically traversed on foot, with all *Eucalypt* trees assessed for their suitability as potential Black Cockatoo breeding habitat. In total, 83 trees were identified and assessed (see Table 3-1), with a more detailed analysis of the recorded data provided in Appendix B.

Figure 3-1 displays the survey effort and *Eucalypt* locations<sup>2</sup>.

**Table 3-1: Survey Findings**

| Species                                     | Total Number of Trees identified | Trees with a DBH <sup>3</sup> > 50 cm | Trees with a DBH < 50 cm |
|---------------------------------------------|----------------------------------|---------------------------------------|--------------------------|
| <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | 83                               | 19                                    | 61                       |
| <i>Eucalyptus tottiana</i>                  |                                  | 2                                     |                          |
| Dead                                        |                                  | 1                                     |                          |

<sup>2</sup> It may appear that not all 83 tree locations are displayed on the map this is due to the fact that some GPS points are laying on top of each other

<sup>3</sup> Diameter of the tree measured at breast height (1.3 m)

Page redacted to protect sensitive species information.

### 3.2 Survey Limitations

**Table 3-2: Survey Limitations (EPA, 2020)**

| Criteria                                                                                                            | Response                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Availability of data and information.                                                                               | Not a limitation.<br>Parts of the survey area have been previously surveyed and ample surveys within 10 km of the current survey area were available for review, including Targeted Black Cockatoo Habitat Surveys.                                                    |
| Competency/experience of the survey team, including experience in the bioregion surveyed.                           | Not a limitation.<br>The field survey lead has over eight years' experience in conducting biological surveys in WA of a similar scope, including the SCP and more specifically within the CoW. She is familiar with the Black Cockatoo Habitat Assessment methodology. |
| Scope of the survey, e.g. where faunal groups excluded from the survey.                                             | Not a limitation.<br>The objective of the Targeted Black Cockatoo Habitat assessment was successfully achieved.                                                                                                                                                        |
| Timing, weather, season.                                                                                            | Not a limitation.<br>The survey was conducted outside of the optimal seasonal timeframe for fauna surveys on the SCP; however, as the scope was limited to a habitat assessment, this timing did not affect the reliability or outcomes of the results..               |
| Disturbance that may have affected results e.g. fire, flood.                                                        | Not a limitation.<br>No natural disturbances i.e. fire or flood have recently occurred within the survey area.                                                                                                                                                         |
| The proportion of fauna identified, recorded or collected.                                                          | Not applicable.<br>The survey was limited to a Targeted Habitat Assessment only.                                                                                                                                                                                       |
| Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent of which the area was surveyed. | Not a limitation.<br>The survey area was comprehensively surveyed.                                                                                                                                                                                                     |
| Access issues.                                                                                                      | Not a limitation.<br>The entire survey area was easily accessible on foot.                                                                                                                                                                                             |



## 4 Discussion and Conclusions

### 4.1 Potential Black Cockatoo Breeding Habitat

Within the proposed clearing area, potential future Black Cockatoo habitat is present in the form of 22 *Eucalyptus* trees with a DBH greater than 50 cm, representing individuals that may develop suitable nesting hollows over time. Under the current project design, up to 16 of these trees are proposed to be removed, resulting in a reduction of prospective breeding habitat within the site.

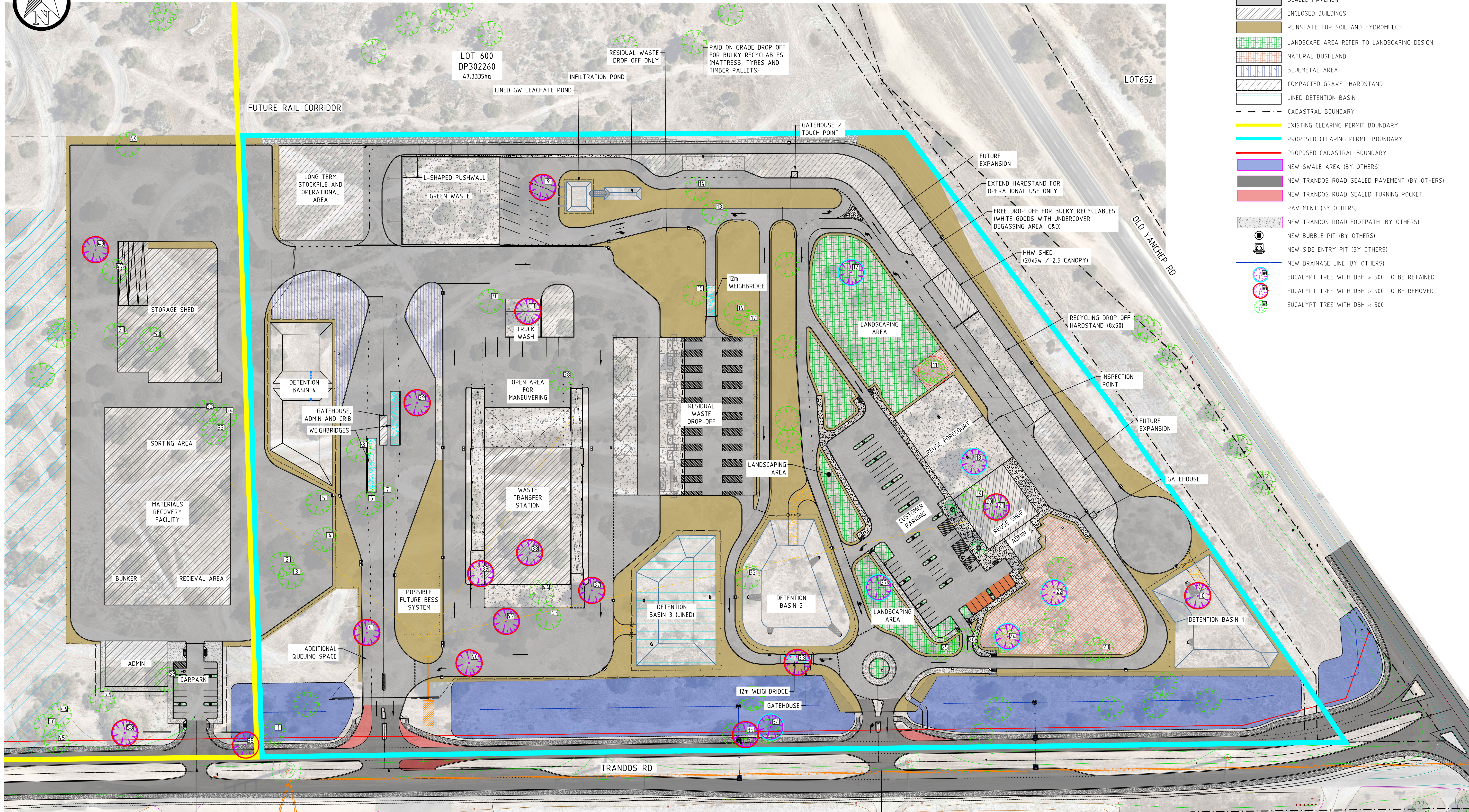
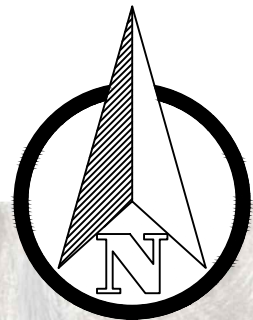
While none of the assessed trees currently contain confirmed or high-quality nesting hollows, the removal of larger, mature individuals may reduce the long-term availability of breeding resources, particularly given the extended timeframes required for hollow formation. In a regional context where suitable nesting habitat is often a limiting factor for Black Cockatoo species, the retention of larger trees can be important for maintain future habitat availability.

**Consideration should therefore be given to avoiding or minimising the removal of higher-value trees where practicable, as well as implementing appropriate mitigation or offset measures to address the potential loss of future habitat values. Drawing 4-1: Site Layout**

outlines the location of Eucalypts recorded during the survey highlighting the significant trees (DBH > 50 cm) which are going to be cleared and retained.



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- LEGEND:**
- SEALED PAVEMENT
  - ENCLOSED BUILDINGS
  - REINSTATE TOP SOIL AND HYDROMULCH
  - LANDSCAPE AREA REFER TO LANDSCAPING DESIGN
  - NATURAL BUSHLAND
  - BLUOMETAL AREA
  - COMPACTED GRAVEL HARDSTAND
  - LINED DETENTION BASIN
  - CADASTRAL BOUNDARY
  - EXISTING CLEARING PERMIT BOUNDARY
  - PROPOSED CLEARING PERMIT BOUNDARY
  - PROPOSED CADASTRAL BOUNDARY
  - NEW SWALE AREA (BY OTHERS)
  - NEW TRANDOS ROAD SEALED PAVEMENT (BY OTHERS)
  - NEW TRANDOS ROAD SEALED TURNING POCKET PAVEMENT (BY OTHERS)
  - NEW TRANDOS ROAD FOOTPATH (BY OTHERS)
  - NEW BUBBLE PIT (BY OTHERS)
  - NEW SIDE ENTRY PIT (BY OTHERS)
  - NEW DRAINAGE LINE (BY OTHERS)
  - EUCALYPT TREE WITH DBH > 500 TO BE RETAINED
  - EUCALYPT TREE WITH DBH > 500 TO BE REMOVED
  - EUCALYPT TREE WITH DBH < 500



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| A   | 11.05.2026 | YJ | JM    | 100% DESIGN ISSUE | JM   |

Project: **NEERABUP MATERIALS RECOVERY FACILITY**

Title: **DBH 500 EUCALYPT TREE LOCATIONS**

|                       |                |                  |  |
|-----------------------|----------------|------------------|--|
| Scale: AS SHOWN @ A1  |                | Date: 03.10.2025 |  |
| Drawn: YJ             | Checked: AB    | Approved:        |  |
| Job No: TC25017       | Drg. No: C-005 | Rev: A           |  |
| Filename: TC25017.DWG |                |                  |  |



#### 4.1.1 Comparison to Western Environmental

The findings of the present survey differ from those reported by Western Environmental (2025) in several key respects:

- The current assessment encompassed the entire proposed clearing footprint, whereas the Western Environmental survey was limited to a subset of the area;
- The Western Environmental assessment included trees with a DBH of less than 50 cm, which is not typically adopted for Black Cockatoo habitat assessments on the SCP, although it may be more applicable in other regions (e.g. the Wheatbelt); and
- Site conditions may have changed since the Western Environmental survey was undertaken, with some previously recorded trees potentially no longer present.

The differences in survey extent and methodology, as well as potential changes in site conditions since the Western Environmental (2025) assessment, have resulted in a higher number of relevant trees being identified during the current survey compared to those documented in the existing approval documentation (Ecoscape, 2021). This discrepancy introduces a level of uncertainty regarding the accuracy and completeness of the baseline information underpinning current approvals and may have implications for both the validity of the approved clearing footprint and the need for reconsideration of referral requirements under the EPBC Act. It may also necessitate further engagement with stakeholders to ensure that decisions are informed by the most up-to-date and comprehensive dataset.

## 4.2 Clearing Permit Advice

Based on the above discussions, it is suggested that a review of the existing NVCP approval and associated appeal (Clearing Permit CPS11015/1) may be appropriate in light of the updated information. There is a need to ensure that the appeal process is informed by accurate and current baseline data, and it is therefore recommended that communication be initiated with the Appeals Convenor to advise of the updated survey findings, particularly where the current appeal may rely on superseded information.

It is also recommended that consultation be undertaken with DWER to seek guidance on the appropriate pathway for addressing the existing NVCP approval in light of the revised dataset. Subject to DWER's advice, this may involve confirmation that the current approval remains valid in its existing form, or alternatively, withdrawal and resubmission of the application to reflect the updated scope and supporting information.

In addition, the proposed clearing may be considered for assessment under Part IV of the EP Act 1986, should the broader proposal be referred to the EPA. An approval issued under Part IV would remove the requirement for a separate NVCP. However, in the extent that the proposal is not subject to formal assessment by the EPA, it is likely that a revised NVCP application would need to be prepared and submitted.

## 4.3 Further Requirements

### 4.3.1 Referral under the EPBC Act 1999

A referral under the *EPBC Act* is required when an action is likely to have a significant impact on listed species and/or communities. For Black Cockatoos, a referral is likely required when the proposed action includes:

- The loss of breeding habitat (known, suitable or potential nesting trees);
- The loss of one or more known or suitable nesting tree
- The loss of known night roosting sites;
- The loss of equal or greater than 1 ha of high-quality foraging habitat; and
- The loss of 1 or more ha of predominantly exotic habitat (i.e. Pine plantations) known to be utilised by Black Cockatoos (DAWE, 2022).

The proposed clearing area is located within the SCP, a region which primarily supports foraging habitat for Black Cockatoo species, with breeding occurring only in isolated instances. Vegetation within the site is dominated by *Melaleuca preissiana* and *Eucalyptus rudis* subsp. *rudis* with scattered *Eucalyptus tottiana* (Ecoscape, 2021). Of these species, *Melaleuca preissiana* and *Eucalyptus rudis* subsp. *rudis* do not provide foraging value for Black Cockatoos, whereas *Eucalyptus tottiana* is recognised as a food source (Bamford, 2020). On this basis, the habitat within the proposed clearing area is considered to represent low-quality foraging habitat. Given the limited extent of the proposed clearing (<10 ha), the potential impact on foraging resources is considered minimal, and referral under the *EPBC Act 1999* is therefore considered not required in this context.

Notwithstanding the above, the proposed clearing of up to 16 potential nesting trees (based on the current survey findings) is likely to require referral under the *EPBC Act*. Following the referral, the Minister (or delegate) will determine, within the statutory timeframe (within 20 business days), whether the proposed action is likely to have a significant impact on listed species and if formal assessment under the *EPBC Act* is required.

### 4.3.2 Offset Requirements

Offsets may be required to address the clearing of potential Carnaby's Cockatoo breeding habitat, with the nature and scale of any offset to be determined in consultation with relevant regulatory authorities. Offset requirements are typically guided by the need to achieve an overall conservation benefit, taking into account both the quality and longevity of impacted habitat.

Commonly adopted measures include the establishment of future breeding habitat through the planting of suitable *Eucalyptus* species within a secured and managed offsite location. This is generally accompanied by long-term management commitments, including weed control, protection from grazing, and monitoring to ensure successful establishment, growth, and recruitment of trees capable of forming nesting hollow over time. Given the extended timeframes required for hollow development, such measures are generally considered a long-term investment in habitat availability.

Where clearing involves trees containing suitable nesting hollows, the installation of artificial nesting structures (e.g. Cockatubes) is often implemented as a supplementary mitigation measure to provide interim breeding opportunities while replacement habitat matures. However, this approach is not considered applicable in this instance, as no hollow-bearing trees are proposed to be removed.



## 5 References

Australian Government (1999) *Environment Protection and Biodiversity Conservation Act 1999*.

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# **Appendix A**

## **Definitions and Field Survey Criteria**

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## Significant / Conservation-listed species definitions and Categories

Significant or conservation-listed fauna according to the EPA (2016) is defined as:

- Being identified as a Threatened or Priority species under the EPBC Act 1999 or BC Act 2016 (definitions below);
- A species with restricted distribution;
- There's a degree of historical impact from threatening processes; and/or
- It provides an important function required to maintain the ecological integrity of a significant ecosystem.

The *EPBC Act 1999* categories for listed flora and fauna species also known as MNES are outlined below:

**Table A-1: EPBC Act Categories for Flora and Fauna**

| Category               | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Extinct                | A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Extinct in the wild    | A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: <ul style="list-style-type: none"> <li>a) It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range, or</li> <li>b) It 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.</li> </ul>                                                                                                                             |
| Critically Endangered  | A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                                                                                                                                                                                           |
| Endangered             | A native species is eligible to be included in the endangered category at a particular time if, at that time: <ul style="list-style-type: none"> <li>a) It is not critically endangered; and</li> <li>b) It is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</li> </ul>                                                                                                                                                                                                                                                                                           |
| Vulnerable             | A native species is eligible to be included in the vulnerable category at a particular time if, at that time: <ul style="list-style-type: none"> <li>a) It is not critically endangered; and</li> </ul> It is facing a high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.                                                                                                                                                                                                                                                                                                            |
| Conservation Dependent | A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: <ul style="list-style-type: none"> <li>a) The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered, or critically endangered; or</li> <li>b) The following subparagraphs are satisfied:               <ul style="list-style-type: none"> <li>(i) The species is a species of fish;</li> <li>(ii) The species is the focus of a plan of management that provides for management actions necessary to stop the</li> </ul> </li> </ul> |

| Category | Definition                                                                                                                                                                                                                                                                                                                                          |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | <p>decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;</p> <p>(iii) The plan of management is in force under a law of the Commonwealth or of a State or Territory;</p> <p>Cessation of the plan of management would adversely affect the conservation status of the species</p> |

The *BC Act 2016* categories for listed flora and fauna species are outlined below (DBCA, 2023):

**Table A-2: BC Act Categories for Flora and Fauna**

| Category                                                          | Code | Definition                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Threatened Species</b>                                         |      |                                                                                                                                                                                                                                                                                                                                                                                                               |
| Critically Endangered                                             | CR   | Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.                                                                                                                                                                                                       |
| Endangered                                                        | EN   | Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.                                                                                                                                                                                                                  |
| Vulnerable                                                        | VU   | Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.                                                                                                                                                                                                                |
| <b>Extinct Species</b>                                            |      |                                                                                                                                                                                                                                                                                                                                                                                                               |
| Extinct Species                                                   | EX   | Species where “there is no reasonable doubt that the last member of the species has died”.                                                                                                                                                                                                                                                                                                                    |
| Extinct in the Wild Species                                       | EW   | Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines. |
| <b>Specially Protected Species</b>                                |      |                                                                                                                                                                                                                                                                                                                                                                                                               |
| Migratory                                                         | MI   | Fauna that periodically or occasionally visit Australian or an external Territory or the Exclusive Economic Zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines.                                                                        |
| Species of special conservation interest (conservation dependent) | CD   | Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines.                                                                                                                                                                               |



## Fauna Field Survey Criteria

Table A-3: Black Cockatoo Potential Nest Tree Grading System (BCE, 2025)

| Ranks | Description of Tree and Hollow activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.                                                                                                                                                                                                                                                                                                                                    |
| 2     | Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3     | Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5m so in a Wheatbelt breeding site a lower criterion may be more appropriate. Note that Rank 3 trees are the most likely to be reassessed with a pole camera and/or drone, and can be either downgraded or upgraded. The Rank 3 assessment should be considered precautionary as it is a tree that has or appears likely to have a suitable nesting hollow. |
| 4     | Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Also, a tree with hollows that might be large enough for a black-cockatoo, but in a trunk or branch of insufficient diameter to contain a hollow of preferred size. Trees with low but otherwise suitable hollows can also be assigned a rank of 4, depending on the context (e.g. south-west forest or Wheatbelt).                                                                                     |
| 5     | Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

NB1. Black-cockatoos favour vertical hollows for the nest chamber, but the hollow entrance may be vertical (a chimney hollow), have a side entrance or have a horizontal spout entrance.

NB2. Chew marks are not always present (or at least visible) around a hollow used by black-cockatoos.

# **Appendix B**

## **Field Survey Results**

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Table B-1: Tree Locations (GDA 2020 Z50)

| Tree Number | Easting  | Northing | Species                                     | DBH                 | Bamford Class | DAWE (2022) Class      |
|-------------|----------|----------|---------------------------------------------|---------------------|---------------|------------------------|
| T09         | 386539.1 | 6495769  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T10         | 386806.3 | 6495603  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T12         | 386664.8 | 6495735  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T18         | 386715   | 6495657  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T21         | 386724.1 | 6495639  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T22         | 386747.6 | 6495604  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T24         | 386728.8 | 6495586  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T27         | 386676.2 | 6495606  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T29         | 386487.8 | 6495681  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T31         | 386533   | 6495719  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T33         | 386642.8 | 6495576  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T34         | 386632   | 6495549  | Dead                                        | >50 cm              | 4             | Potential Nesting Tree |
| T35         | 386621.8 | 6495546  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T37         | 386559.1 | 6495605  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T38         | 386533.7 | 6495620  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T39         | 386513.8 | 6495612  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm <sup>4</sup> | 5             | Potential Nesting Tree |
| T40         | 386509   | 6495575  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |
| T41         | 386467.3 | 6495588  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm              | 5             | Potential Nesting Tree |

<sup>4</sup> Assumed to be larger than 50 cm, measured was not possible due to the presence of bees

| Tree Number | Easting  | Northing | Species                                     | DBH    | Bamford Class | DAWE (2022) Class      |
|-------------|----------|----------|---------------------------------------------|--------|---------------|------------------------|
| T42         | 386524.2 | 6495592  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm | 5             | Potential Nesting Tree |
| T48         | 386358.9 | 6495748  | <i>Eucalyptus rudis</i> subsp. <i>rudis</i> | >50 cm | 5             | Potential Nesting Tree |
| T55         | 386369.8 | 6495548  | <i>Eucalyptus todtiana</i>                  | >50 cm | 5             | Potential Nesting Tree |
| T58         | 386419.1 | 6495543  | <i>Eucalyptus todtiana</i>                  | >50 cm | 5             | Potential Nesting Tree |



Table B-2: Tree Images

|                                                                                     |                                                                                      |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|    |    |    |    |
| T09                                                                                 | T10                                                                                  | T12                                                                                   | T18                                                                                   |
|   |   |   |   |
| T21                                                                                 | T22                                                                                  | T24                                                                                   | T27                                                                                   |
|  |  |  |  |
| T29                                                                                 | T31                                                                                  | T33                                                                                   | T34                                                                                   |



|                                                                                     |                                                                                      |                                                                                      |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |   |   |
| T35                                                                                 | T37                                                                                  | T38                                                                                  | T39                                                                                  |
|   |   |  |  |
| T40                                                                                 | T41                                                                                  | T42                                                                                  | T48                                                                                  |
|  |  |                                                                                      |                                                                                      |
| T55                                                                                 | T58                                                                                  |                                                                                      |                                                                                      |





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