Basic Fauna and Targeted Black Cockatoo Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale

Project No: EP22-113(01)

Prepared for Shire of Serpentine Jarrahdale
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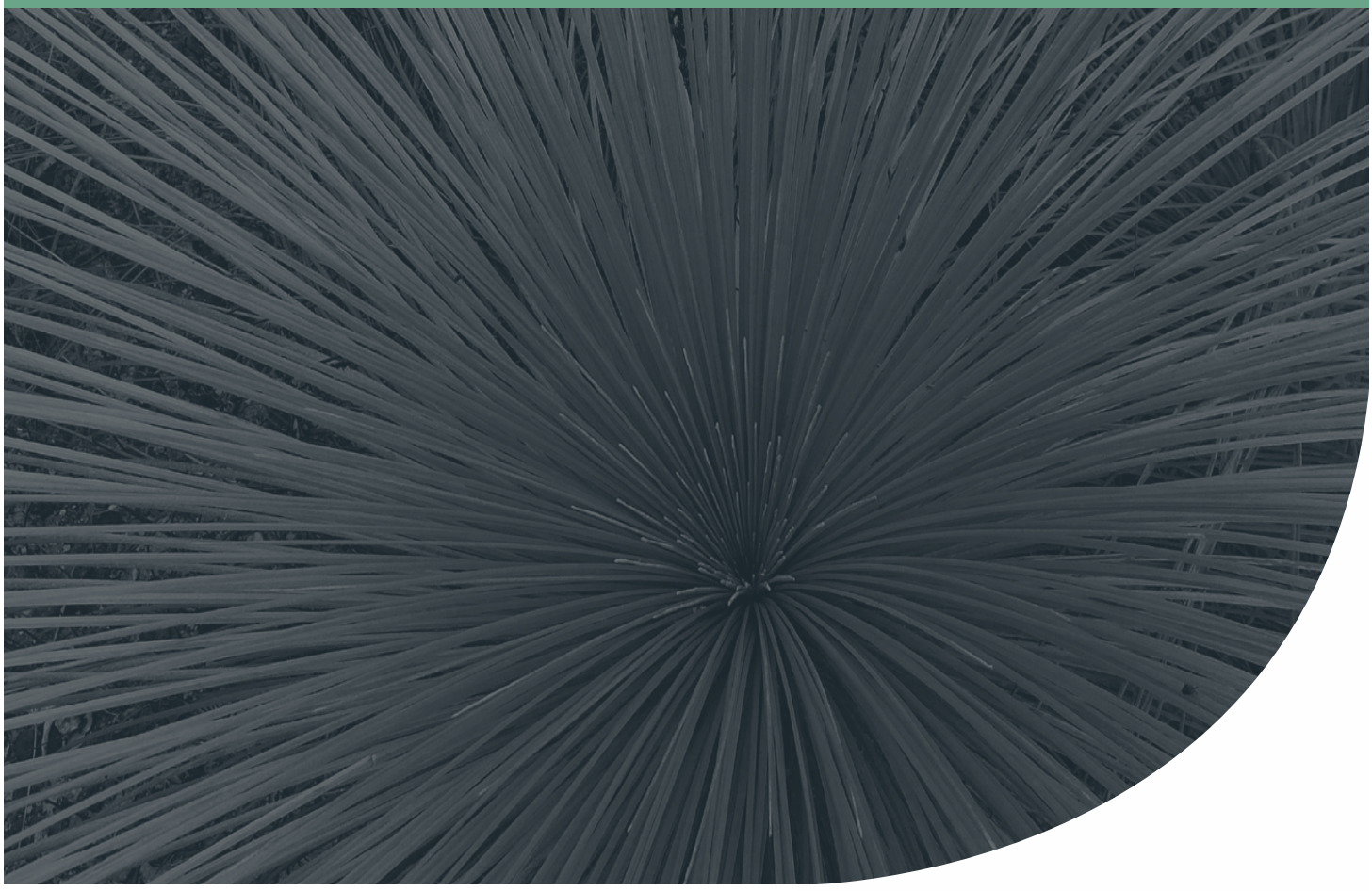

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Executive Summary

The Shire of Serpentine Jarrahdale engaged Emerge Associates to conduct a basic fauna and a targeted black cockatoo assessment within part of two public roads (land ID numbers 3781175 and 3781160 (Atkins Street) in Jarrahdale (the 'site').

As part of the assessment a desktop review of relevant background information was completed, and a field survey was undertaken on 7 November 2022. During the field survey opportunistic sightings of fauna were recorded and an assessment was made on the fauna habitat within the site and its suitability to provide habitat for conservation significant fauna. A targeted black cockatoo survey was also undertaken to determine the presence of habitat for threatened black cockatoo species.

Outcomes of the basic fauna survey include the following:

- Native **eucalypt forest** occurs over approximately 90% of the site that provides habitat for native fauna. The remainder of the site comprises the **cleared land adjacent to the road** with lower habitat values. *Calyptorhynchus banksia naso* (forest red-tailed black cockatoo, 'vulnerable'[1]) was recorded on site along with a further six native species and one non-native species, *Oryctolagus cuniculus* (European rabbit, 'C3 - declared pest'[2]).
- While not recorded during the field survey, *Zanda latirostis* (Carnaby's black cockatoo, 'endangered'[1]) and *Zanda baudinii* (Baudin's black cockatoo, 'endangered'[1]) are considered likely to occur in the site.

It is possible that the following 12 conservation significant species not recorded during the field survey could occur: *Apus pacifus* (Pacific swift, 'migratory'[1]), *Falco peregrinus* (Peregrine falcon, 'other specially protected species'[1]), *Isodon fusciventer* (quenda, 'priority 4'[3]), *Dasyurus geoffroii* (chuditch, 'vulnerable'[1]), *Phascogale tapoatafa wambenger* (south-western brush-tailed phascogale, 'conservation dependant'[2]), *Sentonix brachyurus* (quokka, 'vulnerable'[1]), *Falsistrellus mackenziei* (western false pipistrelle, 'priority'[2]), *Notamacropus irma* (western brush wallaby, 'priority 4'[2]), *Pseudocheirus occidentalis* (western ringtail possum, 'critically endangered'[1]), *Acanthophis antarcticus* (southern death adder, 'priority 3'[2]), *Ctenotus delli* (Dell's skink, 'priority 4'[1]), and the *Euoplos inornatus* (inornate trapdoor spider, 'priority 3'[2]).

Outcomes of the targeted black cockatoo survey include the following:

- The site occurs within the modelled distribution of Carnaby's black cockatoo, Baudin's black cockatoo and the forest red-tailed black cockatoo.
- The site contains 24 habitat trees of which 21 are classified as 'potential nesting trees' and three are 'suitable nesting trees' as determined by inspection from ground level. An internal hollow inspection would be required to confirm whether the hollows in these trees are actually suitable for use by black cockatoos for nesting.

[1] Environment Protection and Biodiversity Conservation Act 1999 and Biodiversity Conservation Act 2016.
[2] Biosecurity and Agriculture Management Act 2007
[3] Biodiversity Conservation Act 2016.

- A Carnaby's black cockatoo roost occurs 260 m from the site and two forest red-tailed black cockatoo roosts occur approximately 5 km from the site (Peck *et al.* 2019). No evidence of roosting by any species of black cockatoo was recorded during the field survey. **Eucalypt forest** within the site has the potential to provide roosting habitat for black cockatoos.
- Foraging evidence of *Calyptorhynchus banksia naso* (forest red-tailed black cockatoo) was recorded during the survey.
- A total of 0.46 ha of primary native foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tailed black cockatoo was mapped within the site.
- Additional areas of foraging habitat of similar value occur adjacent to the site and in the wider local area.

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife (now DBCA)
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WA Museum	Western Australian Museum
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
AFD	Australian Faunal Directory
IBRA	*Interim Biogeographic Regionalisation of Australia*
UFI	Unique feature identifier
EN	Endangered
MI	Migratory
P3	Priority 3
P4	Priority 4
SRE	Short-Range Endemic
VU	Vulnerable
OS	Other specially protected species

Table A3: Abbreviations –Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
CALM Act	*Conservation and Land Management Act 1984*
EBPC Act	*Environment Protection and Biodiversity Conservation Act 1999*
LA Act	*Land Administration Act 1997*
SCRM Act	*Swan and Canning Rivers Management Act 2006*

Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by the Shire of Serpentine Jarrahdale to characterise the fauna and black cockatoo habitat values within part of two public roads (land ID numbers 3781175 and 3781160 (Atkins Street)) in Jarrahdale (referred to hereafter as the 'site'). The site is located approximately 65 kilometres (km) south-east of the Perth Central Business District within the Shire of Serpentine Jarrahdale.

The site is approximately 0.51 hectares (ha) in size and is bounded by rural land to the east, Gooralong Conservation Park to the north and west and Atkins Road to the south. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of works

The scope of work was specifically to undertake a terrestrial vertebrate fauna assessment to the standard required of a 'basic' fauna survey and a 'targeted' black cockatoo survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020) and the *Environment Protection and Biodiversity Conservation Act* black cockatoo referral guidelines (DSEWPaC 2012).

As part of this scope of work, the following tasks were undertaken:

- Desktop assessment of relevant background information pertaining to the site and surrounds, including database and literature searches for fauna species.
- A field survey to identify fauna species and habitats within the site, including habitat for species of black cockatoo.
- Compilation of a list of fauna species with potential to occur within the site as identified from the desktop assessment and opportunistically recorded as part of the field survey.
- Identification of potential habitat for conservation significant fauna species and an assessment of likelihood of occurrence.
- Mapping of fauna and black cockatoo habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

2 Environmental context

2.1 Climate

Climate has a strong influence on the fauna habitat and species present in a region and a site. The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters.

A total of 35.6 millimetres (mm) of rainfall was recorded during the month prior to the survey (October 2022) from the Jarrahdale weather station (no. 9023) which is the closest weather station located approximately 2 km East of the site (BoM 2022). This is lower than the average rainfall of 78.9 mm for the same period and weather station (BoM 2022).

Temperatures recorded in October 2022 ranged from a mean maximum of 18.9°C to a mean minimum of 7.2°C, as recorded by the Karnet weather station (no. 9111) which is the closest temperature recording weather station located approximately 11 km south of the site (BoM 2022). This is slightly lower than the average maximum temperature of 20.8°C and average minimum temperature of 9°C for the same period and weather station (BoM 2022).

On the day of the survey temperatures at the Karnet weather station ranged from a daily maximum of 22°C with no daily minimum recorded (BoM 2022). No rainfall was recorded on the day of the survey by the Jarrahdale weather station (BoM 2022).

2.2 Geomorphology and soils

Landform and soils influence fauna habitat and species at regional and local scales. The site occurs on the Darling Plateau which lies east of the Perth CBD and directly east of the Darling Scarp. The Darling Plateau is an ancient erosion surface capped with laterite and dissected by drainage channels (Beard 1990). The eastern part of the Plateau is characterised by flat-topped hills bound by breakaways and more prominent hills (monadnocks) which protrude above the general level of the plateau (Gozzard 2011). The western part comprises valleys with steep, rocky slopes and narrow, flat floors (Gozzard 2011).

Examination of physiographic region mapping by (Gozzard 2011) places the site in the Murray association, whilst the south-western most corner of the site falls within the Dwellingup association (Churchward and McArthur 1980). The Murray association comprises deeply incised valleys with red and yellow earths on slopes and narrow alluvial terraces. The Dwellingup association comprises a gently undulating landscape with duricrust on ridges and with sands and gravels in shallow depressions. The soil types mapped within the site are shown in **Figure 2**.

The site is not known to contain any restricted landforms or unique geological features.

2.3 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries

(Wetlands Advisory Committee 1977). Many wetlands provide important fauna habitat and support high levels of fauna biodiversity and endemism.

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017c)
- *A Directory of Important Wetlands in Australia* (DBCA 2018*)*.

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows no wetland or water related features occur within the site. However, the perennial waterway (Gooralong Brook) runs approximately 200 m to the north of the site.

2.4 Regional vegetation

Vegetation types and resulting fauna habitats strongly influence the diversity and composition of fauna taxa present within an area. Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000).

The site is contained within the jarrah forest region and within the 'JF1' or northern jarrah forest subregion. The northern jarrah forest subregion is characterised by *Eucalyptus marginata* (jarrah) – *Corymbia calophylla* (marri) forest on laterite gravels with *Eucalyptus wandoo* – marri woodlands in the eastern part (DEC 2002).

Variations in native vegetation can be further classified based on regional vegetation mapping.

DBCA (2019) mapping shows the majority of the southern and western portions of the site as comprising 'Dwellingup, D2' complex which is described as a 'open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones'. The north-eastern portion of the site was mapped as comprising the 'Murray 1, My1' complex which is described as 'open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* - *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* - *Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones'.

2.5 Historic land use

Review of historical images available from 1965 onwards shows that the track to the south of the site has been present since 1965 and was formalised into a road in 1989 (WALIA 2022). The vegetation within the site itself has remained relatively stable in the intervening time.

2.6 Significant fauna

2.6.1 Threatened fauna

Certain fauna taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, fauna taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval.

Threatened fauna species listed under the EPBC Act and/or BC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Further information on threatened species and their categories is provided in **Appendix A**.

2.6.1.1 Black cockatoos

Three threatened species of black cockatoo occur in the south-west of WA (referred to herein collectively as 'black cockatoos'):

- *Zanda*[4] *latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda*[5] *baudinii* (Baudin's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories:

- Black cockatoos nest in hollows that form in trees which are usually more than ~200 years old. 'Breeding habitat' comprises 'habitat trees' which are trees of a species known to support black cockatoo breeding and which either have a suitably large enough nest hollow or have a large enough diameter at breast height (DBH) to indicate that a suitable nest hollow could develop in time (DSEWPaC 2012). A minimum DBH for a habitat tree is defined as ≥50 centimetres (cm) for most tree species used by black cockatoos and ≥30 cm for *Eucalyptus wandoo* (wandoo) and *Eucalyptus salmonophloia* (salmon gum) (DSEWPaC 2012). Breeding habitat is also generally expected to be located within 6 km of food and water resources (DPaW 2013).
- Roosting refers to black cockatoos congregating in a tree or group of trees to rest overnight. 'Roosting habitat' consists of groups or individual tall trees used for roosting. Roosts generally comprise the tallest trees in an area and can include native and non-native trees (DSEWPaC 2012). They are often located within 6 km of water and food resources, with additional foraging ranges within 12 km (Shah 2006; DSEWPaC 2012; Le Roux 2017). The use of a particular roost may vary depending on availability of food and water resources.

[4] Previously *Calyptorhynchus*
[5] Previously *Calyptorhynchus*

- Black cockatoos feed on the fruit and seeds of a range of native and non-native plant species. 'Foraging habitat' is vegetation that contains plant species known to be foraged on by black cockatoos.

Each black cockatoo species has a defined breeding season, with Baudin's black cockatoo breeding from August/September to February/March and Carnaby's black cockatoo breeding from July/August to January/February (DSEWPaC 2012). Forest red-tailed black cockatoo breeds in October/November but may breed in March/April if there is good autumn rainfall (DSEWPaC 2012). There is also evidence that forest red-tail black cockatoos breed throughout the year, with peaks in April – June and August – October (Johnstone *et al.* 2013).

2.6.2 Priority fauna

Fauna species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA *Priority Fauna List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes. Further information on priority species and their categories is provided in **Appendix A**.

2.6.3 Migratory fauna

Some fauna species that migrate to Australia and its external territories or pass though or over Australian waters during their annual migrations are protected under Commonwealth and State legislation. At a Commonwealth level, migratory fauna taxa may be listed as 'migratory' under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval. Further information on migratory species is provided in **Appendix A**.

2.6.4 Specially protected fauna

In Western Australia, fauna species that are of special conservation interest, including migratory species and cetaceans, species subject to international agreement or species otherwise in need of special protection may be listed as 'specially protected' under the BC Act. Further information on specially protected species and their categories is provided in **Appendix A**.

2.7 Pest fauna

The term 'pest fauna' can refer to any animal that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Pest fauna species are generally not native, but some Australian or Western Australian fauna may also be considered pests.

A particularly invasive or detrimental pest species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Current pest status and control categories for Western Australia are provided in the *Western Australian Organism List* (DPIRD 2022). Further information on categories of declared pests is provided in **Appendix A**.

2.8 DBCA managed or legislated land

DBCA has tenure of, or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the *Legislated Lands and Waters* (DBCA 2021b) and *Lands of Interest* (DBCA 2021a) datasets. The *Legislated Lands and Waters* (DBCA 2021b) dataset includes lands subject to the following legislation; the *Conservation and Land Management Act 1984* (CALM Act 1984), *Swan and Canning Rivers Management Act 2006* (SCRM Act) and lands identified under the *Land Administration Act 1997* (LA Act). The *Lands of Interest* (DBCA 2021a) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Lands as the responsible agency.

The western boundary of the site is directly adjacent to the 'Gooralong Conservation Park' (R 990) which is part of the 'Serpentine National Park' that extends to the south (DBCA 2017a).

2.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There are no mapped ecological linkages within or in close proximity to the site. One regional ecological linkage (No. 156) occurs approximately 600 m east of the site running from north to south.

Review of aerial imagery indicates that much of the vegetation within the site is connected to extensive areas of native vegetation within the local area.

2.10 Previous surveys

No previous surveys are known to have been completed within the site.

3 Methods

3.1 Desktop assessment

3.1.1 Basic fauna

A search was conducted for fauna species that have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022a), *Naturemap* (DBCA 2023), *Atlas of Living Australia* (Atlas of Living Australia 2022) and literature references.

3.1.2 Black cockatoo

A search was conducted for records of black cockatoos and potential black cockatoo habitat mapping occurring within 12 km of the site using a range of publicly available regional studies and datasets. Detailed information on each dataset considered as part of the desktop review is provided in **Appendix A**.

3.2 Field survey

An ecologist from Emerge visited the site on the 7 November 2022 during the day to conduct the basic fauna survey and targeted black cockatoo field survey. The survey was conducted from approximately 10:00 am until 3:00 pm.

3.2.1 Basic fauna

Transects were traversed across the site, during the day, and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

An opportunistic fauna species list was compiled, and fauna habitat values were described, with particular reference to conservation significant fauna species with potential to occur within the site.

3.2.2 Targeted black cockatoo

Transects were traversed across the site and the presence of potential black cockatoo breeding, night roosting and foraging habitat was recorded. If observed, the presence of black cockatoos within or near the site was noted. Active searches for evidence of breeding, roosting and foraging activity such as chew marks, branch clippings, droppings, moulted feathers and chewed marri or banksia fruit were conducted.

3.2.2.1 Breeding habitat

A ‘habitat tree’ was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a DBH ≥50 cm or DBH ≥30 cm for wandoo or salmon gum. As any tree that has a suitable hollow may provide breeding habitat for black cockatoos, other tree species were also considered to be habitat trees if they contained a suitable hollow.

To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- have an entrance opening of at least 10 cm but preferably 20-30 cm (Saunders *et al.* 1982; Groom 2010; Johnstone *et al.* 2013)
- be located at least 3 m from the ground (Saunders 1979b; Johnstone and Storr 1998a; Groom 2010; Saunders 2014)
- be located in a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50-200 cm such that it could house an adult black cockatoo and nestlings (Saunders 1979a; Johnstone and Storr 1998a; Saunders 2014; DPaW 2015)
- have vertical or near vertical orientation (Johnstone and Kirkby 2008; Johnstone *et al.* 2013).

Occasionally, native eucalypts were encountered that met DBH requirements but did not contain a trunk/branch of a sufficient size to support a hollow suitable for use by black cockatoos. For example, the tree may have been less than 3 m tall or had a trunk that forked between 1.3 m and 3 m in height and after the fork no limbs had a diameter of ≥50 cm or ≥30 cm for wandoo or salmon gum. These trees were not recorded as habitat trees as the likelihood they would form a suitable hollow was low.

Habitat trees were individually identified, and the attributes outlined in **Table 1** were recorded for each tree.

Table 1: Attributes recorded for each habitat tree in the site.

Attribute	Description
Image	Trees were individually photographed
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 m) using a diameter tape
Hollows potentially suitable for breeding by a black cockatoo	Number of hollows potentially suitable for breeding by a black cockatoo recorded (assessed from ground level only)

Each habitat tree was assigned to a category listed in **Table 2**.

Table 2: Habitat tree categories (DAWE 2022b).

Category	Specifications
Known nesting tree	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).
Suitable nesting tree	Trees with suitable nesting hollows present, although no evidence of use. Note that any species of tree may develop suitable hollows for breeding. Hollow confirmed by internal hollow inspection^.
Potential nesting tree	Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.

^Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in **Section 3.2.2.1**

3.2.2.2 Roosting habitat

The presence of active or historical roosts was determined through evidence of roosting activity, such as branch clippings, droppings or moulted feathers.

If present, groups of tall native and non-native trees were assumed to provide roosting habitat.

3.2.2.3 Foraging habitat

Foraging habitat was identified by assessing vegetation in the site for plant species known to provide food for black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998a; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DAWE 2022b).

Foraging habitat was classified as either 'native' or 'non-native' based on the predominant vegetation's naturalised status. It was also classified as either 'primary' or 'secondary' based on black cockatoo foraging preferences. Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plants that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource. A list of plant species classified as primary or secondary food plants is provided as **Appendix C**.

Each patch of foraging habitat was assigned a foraging value for each species of black cockatoo likely to occur within the site. As it is not always possible to separate out food plants from non-food plants, mapped foraging habitat may also include vegetation comprising non-food plants. The proportion of non-food plants in mapped foraging habitat was minimised as far as practicable.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a species where possible.

3.3 Data analysis

3.3.1 Desktop assessment

A total number of species that occur or potentially occur within the desktop assessment search area was calculated by adding the total count of non-conservation significant species provided by *NatureMap* to the combined number of conservation significant species provided by *NatureMap* and *Protected Matters Search Tool*. The habitat requirements of conservation significant vertebrate fauna were specifically reviewed to verify they did in fact have potential to occur in the site (that is marine mammals and fish were omitted).

3.3.2 Fauna habitat

Fauna habitats were described according to the dominant flora species and vegetation type present, as determined from observations made during the field survey and information provided in the '*Detailed Flora and Vegetation Assessment*' (Emerge Associates 2022).

The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, Emerge Associates (2022) plant communities and notes taken in the field.

3.3.3 Likelihood of occurrence

Information on habitat preferences and distribution of conservation significant fauna species with potential occur within the site or wider area was reviewed and assessed against the general site conditions and fauna habitat types recorded during the field survey.

Based on the results of the desktop assessment and information recorded during the field survey, an assessment of the likelihood of occurrence of conservation significant fauna within the site was undertaken using the categories outlined in **Table 3**.

Table 3: Likelihood of occurrence assessment categories and definitions

Likelihood of occurrence	Definition
Recorded	The species was recorded during the current field survey or during previous field surveys.
Likely	The site contains suitable habitat for the species, and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains habitat of at least marginal quality and/or extent for the species and the site is located within the known distribution range of the species which is supported by recent literature records from near the site.
Unlikely	The site contains no or marginal habitat for the species and/or no recent literature records occur near the site.

3.3.4 Black cockatoo habitat

3.3.4.1 Habitat trees

Habitat trees were classified according to the scheme outlined in **Table 2** and mapped on aerial imagery. A complete summary of the recorded attributes of habitat trees was compiled in a tabular format.

3.3.4.2 Foraging habitat value

Foraging habitat was described according to the dominant flora species or vegetation type present and mapped using boundaries interpreted from aerial photography and notes taken in the field. The foraging value of each patch of foraging habitat was attributed separately for each species of black cockatoo likely to occur in the site. Foraging value was assigned as outlined in **3.2.2.3**.

3.4 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for mammals, reptiles and amphibians follow *the Western Australian Museum* (WAM) *Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2021). For birds taxonomy and nomenclature of scientific and common names follows the Australian Faunal Directory (AFD) (DoEE 2021). Where common names were not provided by the WAM or the AFD, these have been derived from other sources as noted.

Literature listed in **Appendix A** represent the main publications used to identify fauna species and habitats within the site.

3.5 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in **Table 4**.

Table 4: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A basic survey (desktop study and field survey) in combination with a targeted black cockatoo survey was undertaken. The level of survey and survey effort are considered adequate to assess the fauna and black cockatoo habitat values within the site.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus on black cockatoos and other conservation significant taxa with potential to occur within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	All observed vertebrate fauna were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and literature references.
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	No limitation	This fauna and black cockatoo assessment was undertaken by a qualified ecologist with over 11 years of zoological experience in Western Australia. Technical review was undertaken by a principal environmental consultant with over 19 years' experience in environmental science in Western Australia.
Suitability of timing, weather and season	No limitation	Survey timing is not considered to be of great importance for basic fauna assessments but the weather conditions during the survey were ideal for detecting fauna species. The survey was undertaken during the black cockatoo peak breeding season to maximise the chance of detecting breeding behaviour. However, many black cockatoo individuals leave the Swan Coastal Plain (SCP) during this time and migrate to breeding areas and as such the detectability of roosting activity was reduced.
Completeness	No limitation	The desktop assessment, field survey and targeted black cockatoo components of the survey were completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.

Table 5: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020) (continued)

Constraint	Degree of limitation	Details
Survey intensity	No limitation	The intensity of the survey was adequate given the small size of the site.
Influence of disturbance	No limitation	The disturbance history of the site was taking into account when planning the survey. No recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available. The guidance currently available from Commonwealth and State agencies on the assessment of black cockatoo habitat is limited and relies heavily on technical experts preparing their own methodology. This assessment applies an internally developed methodology that is considered to provide a systematic and balanced characterisation of black cockatoo habitat.
Compliance with EPA (2020) guidance	Minor limitation	The EPA guidance requires that a full list of all fauna species with potential to occur within the site is compiled. As part of this assessment a comprehensive list of fauna species of conservation significance was compiled. Non-conservation taxa with potential to occur within the site were not compiled into a list but are provided as raw data in **Appendix B**. Given that all species with potential to occur within the site are still identified within the relevant appendices this is not considered to affect the outcomes of this assessment.

4 Results

4.1 General site conditions

The site comprises a gentle east facing vegetated slope on the edge of the Serpentine National Park. Portions of the site showed recent evidence of a low intensity burn.

4.2 Fauna habitat

Eucalypt forest and cleared area occur in the site as indicated in **Table 5** and a representative photograph is provided in **Plate 1**. The fauna habitat is shown on **Figure 5**.

Table 5: Fauna habitats identified within the site.

Fauna habitat	Description	Area (ha)
Eucalyptus forest	Open forest of *Eucalyptus marginata* and *Corymbia calophylla* over shrubland of *Xanthorrhoea preissii*, *Macrozamia riedlei* and *Pteridium esculentum,* over open vineland of *Clematis pubescens* and *Hardenbergia comptoniana* on lateritic gravel (**Plate 1**).	0.46
Cleared	Area cleared on the edge of Atkins Street (**Plate 2**)	0.04

Plate 1: Open eucalypt forest.

Plate 2: Cleared area along Atkins Street.

4.3 Fauna

4.3.1 Desktop assessment

A total of 550 fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site[6] as listed in **Appendix B.**

Of these species, 37 are conservation significant, including 18 threatened, 13 priority, 6 migratory fauna and 2 other specially protected species as listed in **Appendix D**.

4.3.2 Species inventory

There were five fauna species directly recorded during the survey. However, digging evidence of rabbits, scats from western grey kangaroo and foraging evidence of forest red-tailed black cockatoos were also noted.

A complete species list is provided in **Appendix E**.

4.3.3 Conservation significant fauna

Evidence of foraging by forest red-tailed black cockatoos in the form of chewed marri and jarrah fruit was recorded in the site.

[6] Includes native and non-native species

Additionally, four species of conservation significance were considered to likely occur with another 11 conservation significant species considered to possibly occur in the site based on habitat requirements species distribution and site conditions, as shown in **Table 6**.

The remainder of the conservation significant fauna species identified in the desktop assessment are considered unlikely to occur in the site due to lack of suitable habitat or because the site lies outside of the species known distribution. Fauna species classed as unlikely to occur are listed in **Appendix D**.

Table 6: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		BC Act	EPBC Act		
Birds					
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey and Knight 2012).	**Possible** May opportunistically occur in or fly over the site on commute or while searching for prey.
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding *Corymbia calophylla*, *Eucalyptus marginata*, introduced *Melia azedarach* and Eucalyptus spp. Trees (Johnstone *et al.* 2011).	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998b).	**Possible** May opportunistically occur in or fly over the site on commute or while searching for prey.
Zanda baudinii	Baudin's black cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding *Corymbia calophylla*, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998b).	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Hakea spp., Eucalyptus spp., *Corymbia calophylla,* Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998b).	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.

Table 6: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		BC Act	EPBC Act		
Invertebrate					
Euoplos inornatus	Inornate trapdoor spider	P3	-	Has previously been recorded in jarrah forest, including near clay banks and granite outcrop. Most records are from the Darling scarp/Jarrah Forest Region, with limited records from the Swan Coastal Plain (DBCA 2020)	Possible Suitable habitat and within species distribution. Previous records nearby
Mammal					
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches, and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012a).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012b)	Possible: Suitable habitat (woodland/forest) occurs in the site.
Notamacropus irma	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1984).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017b).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Setonix brachyurus	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	Possible: Suitable habitat (woodland/forest) occurs in the site.

Table 6: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		BC Act	EPBC Act		
Reptile					
Acanthophis antarcticus	Southern death adder	P3	-	Mostly in woodlands, grasslands and heaths. In the Darling Range this species is typically found within Eucalyptus marginata woodlands adjacent to granite outcrops and along densely vegetated creeks (Bush *et al.* 2007).	Possible: Suitable habitat (woodland/forest) occurs in the site.
Ctenotus delli	Dell's skink	P4	-	Jarrah and marri woodland with a shrub dominated understorey, sheltering in dense vegetation, inside grass trees and beneath rocks, sometimes in burrows (Nevill 2005)	Possible: Suitable habitat (woodland/forest) occurs in the site.

4.4 Black cockatoos

4.4.1 Desktop assessment

The site is located within the distribution range of Carnaby's black cockatoo and forest red-tailed black cockatoo and within the north-western most extent of the Baudin's black cockatoo distribution range (DoEE 2016c, b, a).

The site is located within the Carnaby's black cockatoo modelled breeding range but not within Baudin's black cockatoos breeding range (DoEE 2016b, a).

No breeding range information for forest red-tailed black cockatoo is provided in DoEE (2016c). However, on the Swan Coastal Plain the species is known to breed near Baldivis, Mundijong, Stake Hill, Karnup, Murdoch and possibly Perry Lakes (Johnstone *et al.* 2017).

A roost site associated with white-tailed black cockatoos occurs within 280 m of the site and a roost site-associated with forest red-tailed black cockatoos occurs approximately 2.5 km north-west of the site.

The results of the black cockatoo desktop assessment are summarised in **Table 7** and shown in **Figure 6**.

Table 7: Summary of black cockatoo background review

Category		Site context	Source
Species distribution		• Site is located within the modelled distribution range of Carnaby's black cockatoo and within its breeding range. • Site is located within the modelled distribution range of Baudin's black cockatoo but not within its breeding range. • Site is located within the modelled distribution range of forest red-tailed black cockatoo.	(DoEE 2016a, b, c)
Carnaby's black cockatoo breeding areas (12 km radius surrounding breeding sites)		• No confirmed breeding areas intersect the site.	(Glossop *et al.* 2011)
Important bird areas for Carnaby's black cockatoo		• Site is located within the 'Northern Swan Coastal Plain' IBA. • The Northern Swan Coastal Plain IBA is estimated to support 4600-15000 Carnaby's cockatoos during the non-breeding season and a small number of breeding individuals, forming the largest population of non-breeding birds in south-western Australia (BirdLife International 2022).	(DPaW 2013; BirdLife International 2022)
Roost site		• 15 roost sites within 12 km of the site (Table 8 and Table 9): • ◦ 2 associated with white-tailed^ black cockatoos only. • ◦ 8 associated with forest red-tailed black cockatoos only. • ◦ 5 associated with white^ and red-tailed black cockatoos.	(Peck *et al.* 2019) and Birdlife/DBA database search
Foraging habitat	Carnaby's black cockatoo	• Potential native foraging habitat is mapped in the northern, eastern and western portion of the site. • Additional areas of potential native foraging habitat mapped within the wider local area, including adjacent to the western, northern and eastern portion of the site.	(Emerge Associates 2021)
		• No pine plantations mapped within the site or within 12 km.	(Forest Products Commission 2020)
	Baudin's black cockatoo	• Potential native foraging habitat is mapped in the northern, eastern and western portion of the site. • Additional areas of potential native foraging habitat mapped within the wider local area, including adjacent to the western, northern and eastern portion of the site.	(Emerge Associates 2021)
	Forest red-tailed black cockatoo^	• Potential native foraging habitat is mapped in the northern, eastern and western portion of the site. • Additional areas of potential native foraging habitat mapped within the wider local area, including adjacent to the western, northern and eastern portion of the site.	(Emerge Associates 2021)

^Carnaby's and/or Baudin's black cockatoo

Table 8: White-tailed black cockatoos recorded in roosts within 12 km of the site (Peck et al. 2019) and Birdlife/DBA database search

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SERKEYR003	NS	NS	NS	NS	NS	NS	NS	255	352	211
SERBYFR004	NS	NS	NS	NS	NS	NS	111	7	0	0
SERWHIR001	NS	NS	NS	NS	NS	NS	34	0	56	NS
SERJARR001	0	60	0	NS	NS	0	NS	0	0	NS
SERKEYR002	25	NS	0	30	NS	0	NS	0	NS	NS
SERSERR008	NS	NS	NS	NS	NS	NS	NS	NS	NS	23
SERMUNR002	NS	NS	NS	NS	NS	NS	10	12	NS	0

NS = not surveyed

Table 9: Forest red-tailed black cockatoo recorded in roosts within 12 km of the site (Peck et al. 2019) and Birdlife/DBA database search

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
SERBYFR004	NS	NS	88	32	9	0
SERJARR003	NS	NS	30	59	0	5
SERJARR004	NS	NS	NS	NS	NS	45
SERSERR008	NS	NS	NS	NS	NS	41
SERSERR006	NS	NS	NS	NS	NS	38
SERKEYR002	NS	37	NS	0	NS	NS
SERSERR005	NS	NS	12	0	4	NS
SERSERR003	NS	0	3	0	9	3
SERKARR001	NS	NS	NS	NS	8	NS
SERJARR002	NS	NS	NS	7	0	0
SERKEYR003	NS	NS	NS	0	0	5
SERMUNR002	NS	NS	0	4	NS	0
ARMASHR001	NS	NS	NS	3	NS	NS

NS = not surveyed

4.4.2 Habitat

4.4.2.1 Breeding

A total of 24 black cockatoo habitat trees were recorded within the site as shown in **Figure 5**.

The habitat trees comprised 13 marri and 11 jarrah trees.

The 3 trees categorised as suitable nesting trees (Tree ID 6, 13 and 24) were classified as such from ground inspection according to presence and estimated diameter of hollows. Hollow inspection is required to confirm these classifications.

A summary of the habitat trees recorded within the site is provided in **Table 10** and an inventory in **Appendix F**. Details of habitat trees with suitable and potentially suitable hollows recorded in the current survey is provided in **Appendix G**.

Table 10: Habitat trees recorded within the site

Category	No. trees
Known nesting trees	0
Suitable nesting trees	3
Potentially suitable nesting trees	21
Total habitat trees	24

4.4.2.2 Roosting

No roosts or evidence of roosting were observed within the site during the survey.

Native trees within the site have the potential to provide roosting habitat for black cockatoos.

4.4.2.3 Foraging

A total of 0.46 ha of foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tailed black cockatoo was recorded in the site as shown **Figure 6**.

The majority of the foraging habitat occurs as a contiguous area of mixed woodland vegetation and comprises a combination of primary, secondary and non-food plants. Dominant primary food plants are jarrah and marri. Dominant secondary food plants include *Xanthorrhoea preissii* (grass tree), *Banksia grandis* (bull banksia) and *Banksia sellis* (parrot bush).

The extent of foraging habitat by value category is detailed in **Table 11**.

Table 11: Foraging habitat values recorded within the site.

Foraging value	Black cockatoo species and area of foraging habitat (ha)		
	Carnaby's	Baudin's	Forest red-tailed
Native primary	0.46	0.46	0.46
Native secondary	0	0	0
Non-native primary	0	0	0
Non-native secondary	0	0	0
Total	0.46	0.46	0.46

5 Discussion

5.1 Fauna and fauna habitat

The seven native fauna species recorded within the site are generally common across the Jarrah Forest and surrounding regions. Records of these species are therefore not unexpected. The small number of species recorded reflects the low intensity of the survey, as well as the small size of the site.

Most of the site (90%) consists of eucalyptus forest that is connected to Gooralong Conservation Park. It therefore exists as a part of a larger contiguous area of native forest that is managed for conservation. While the highest habitat values in the site are associated with **Eucalypt forest,** the **Cleared** area also has some value. Edges offer both unique foraging and refuge opportunities and influence microclimate as they may be impacted differently by wind or heat, have different soil drainage and generally contain less dense vegetation (Elisa Hardt 2013). These qualities mean a habitat edge may be utilised by different fauna to habitat interiors or utilised by the same fauna species for different purposes (M. Pfeifer 2017).

5.2 Conservation significant fauna (excluding black cockatoos)

Quenda are widespread small to medium marsupials listed as priority 4 (P4) in Western Australia. The site consists of a thick herbaceous and shrubby understory that would provide good cover and foraging area for quenda, therefore making it likely that they occur in the site. Their lack of record in the site may be due to the time of survey and individuals utilizing the adjacent conservation park.

The Pacific swift (MI) and Peregrine falcon (OS) are two conservation significant species considered to possibly occurred in the site. Both these species are highly mobile and may opportunistically fly over or forage in the site for short periods of time as part of a much larger home range. Neither of these species would breed within the site. Any occurrence of Pacific swift in the site would likely be in the air space and largely independent from terrestrial habitat.

Chuditch (VU) and south-western brush-tailed phascogale (CD) are two mammals that are associated with the Jarrah Forest. However, while either species could utilize the habitat within the site, the likelihood of them doing so may be low due to the site's relatively small size, existing as a forest edge and its proximity to urban development. Both species have reasonably large home ranges so any occurrences on site would likely be as an occasional visitor.

Quokka (VU) are known to persist on the Western Australian mainland in small pocket populations across the south-west, including the northern Jarrah Forest (DEC 2013). Nearby records from the past decade indicate that the population may persist in the Gooralong Conservation Park, and subsequently, may possibly occur in the site. However, the lack of recent regular burning within the site boundary means the habitat may offer low foraging habitat values for the species, which prefers new regrowth. As a result, individuals may be unlikely to utilise the area (Department of Biodiversity Conservation and Attractions 2017).

The western false pipistrelle (P4) may possibly roost and forage within the site. The species' habitat includes jarrah forests where they utilize old eucalyptus tree hollows to roost. A nocturnal survey and hollow inspection would be required to confirm the presence or absence of the species.

Western brush wallaby (P4) may possibly occur in the site; however the species is poorly understood, both in its foraging preference and breeding times. Therefore, its absence during the survey may be a result of survey timing not lining up with periods of high mobility for the species, or that the site provides little foraging value.

The inornate trapdoor spider (P3) is an SRE (short range endemic) species that may possibly occur in the site. SRE's are fauna species with naturally restricted geographic distributions of less than 10,000 km² (Harvey 2002). Specialised habitats such as mountainous terrain, caves and freshwater habitats often harbour SREs (Harvey 2002; EPA 2016). Whilst the inornate trapdoor spider has been recorded in the Jarrah Forest, like many SRE species their biology is poorly understood, and distribution records are limited. The species also have unornamented burrow lids which are particularly difficult to locate in thick, unburnt Jarrah leaf litter. Given the site contains contiguous forest habitat with the surrounding conservation park area, it does not convey high value habitat for SRE species that could be differentiated from the surrounding area.

The western ringtail possum (CR), southern death adder (P3) and Dell's skink (P4) are all known to inhabit the northern Jarrah Forest and vegetation similar to the habitat within the site. However, local records for these species are not recent (>30 years). As their current abundance and distribution is not easily determined, the degree to which it is possible they could occur is difficult to forecast.

5.3 Black cockatoo habitat values

Foraging evidence attributed to forest red-tailed black cockatoo (VU) was recorded on site. This is not unexpected as the area contains primary native foraging habitat and is within the modelled distribution ranges (DBCA 2023). While not recorded during the survey, Carnaby's black cockatoo (EN) and Baudin's black cockatoo (EN) are known to forage in the area.

5.3.1 Breeding

Three habitat trees were classified as suitable nesting trees (DAWE 2022b) as they appeared to contain hollows that could be suitable for use by black cockatoos for nesting from the ground. The hollows in these trees would need to be internally inspected to confirm whether they are in fact suitable. The rest of the 21 habitat trees were classified as potential nesting trees as they do not contain suitable hollows but have the potential to form suitable hollows in the future.

5.3.2 Roosting

A small Carnaby's black cockatoo roost (60 individuals) is recorded approximately 300 m east of the site. According to Peck *et al.* (2019) and Glossop *et al.* (2011) "large trees (>8 m height) within 500 m of a small roost may be considered to be 'roost trees' or 'potential roost trees'."

No secondary evidence of roosting such as branch clippings, droppings or feathers were observed within the site. Therefore, there is no reason to suspect that roosting by black cockatoos has recently

occurred. Nevertheless, the site contains tall trees that have the potential to provide roosting habitat for black cockatoos.

5.3.3 Foraging

The site contains 0.46 ha of primary native foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tailed black cockatoo.

The dominant primary native food plants include marri and jarrah. The understory also consists of secondary native food plants including grass tree, bull banksia, parrot bush. While not insignificant, the foraging habitat within the site is a relatively small resource in comparison to extensive areas of similar value foraging resource that occur adjacent to site and in the wider local area, including Gooralong Conservation Park.

6 Conclusions

6.1 Fauna and habitat

The majority of the site (90%) supports native **eucalypt forest**. The remainder of the site consists of **cleared** land adjacent to the road (10%).

A total of seven native fauna species were recorded including forest red-tailed black cockatoo (vulnerable) and rabbit (declared pest).

While not recorded during the field survey, Carnaby's black cockatoo (endangered), Baudin's black cockatoo (endangered) and quenda (priority 4) are likely occur on site.

It is possible that the following 12 conservation significant species not recorded during the field survey could occur including: Pacific swift (migratory), Peregrine falcon (other specially protected species), Dasyurus geoffroii (vulnerable), south-western brush-tailed phascogale (conservation dependent), quokka (vulnerable), western false pipistrelle (priority), western brush wallaby (priority 4), western ringtail possum (critically endangered), southern death adder (priority 3), Dell's skink (priority 4), and the inornate trapdoor spider (priority 3).

6.2 Black cockatoos

The site occurs within the modelled distribution of Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tailed black cockatoo. Foraging evidence of forest red-tailed black cockatoo was recorded during the survey.

The site contains 24 habitat trees of which three are suitable nesting trees determined by ground inspection. These require internal hollow inspection to confirm suitability for nesting by black cockatoos. The remaining 21 trees were classified as potentially suitable nesting trees.

A Carnaby's black cockatoo roost occurs 260 m from the site and two forest red-tailed black cockatoo roosts occur approximately 5km north of the site (Peck *et al.* 2019). No roosts or evidence of roosting by any species of black cockatoo was recorded within the site during the field survey. Tall native and non-native trees within the site represent suitable roosting habitat for species of black cockatoo.

A total of 0.46 ha of primary foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and forest red-tail black cockatoo was mapped within the site.

Additional areas of primary native foraging habitat occur adjacent to the site and in the wider local area throughout Gooralong Conservation Park.

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7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
Atlas of Living Australia (2022)	14 March 2023	The Atlas of Living Australia's Spatial Portal
BirdLife International (2022)	14 March 2023	Important Bird Areas
BoM (2022)	14 March 2023	Climate Data Online
DAWE (2022)	9 March 2023	Protected Matters Search Tool
DBCA (2022)	9 March 2023	NatureMap
DoEE (2021)	14 March 2023	Australian Faunal Directory
WALIA (2022)	14 March 2023	Landgate Map Viewer

Figures

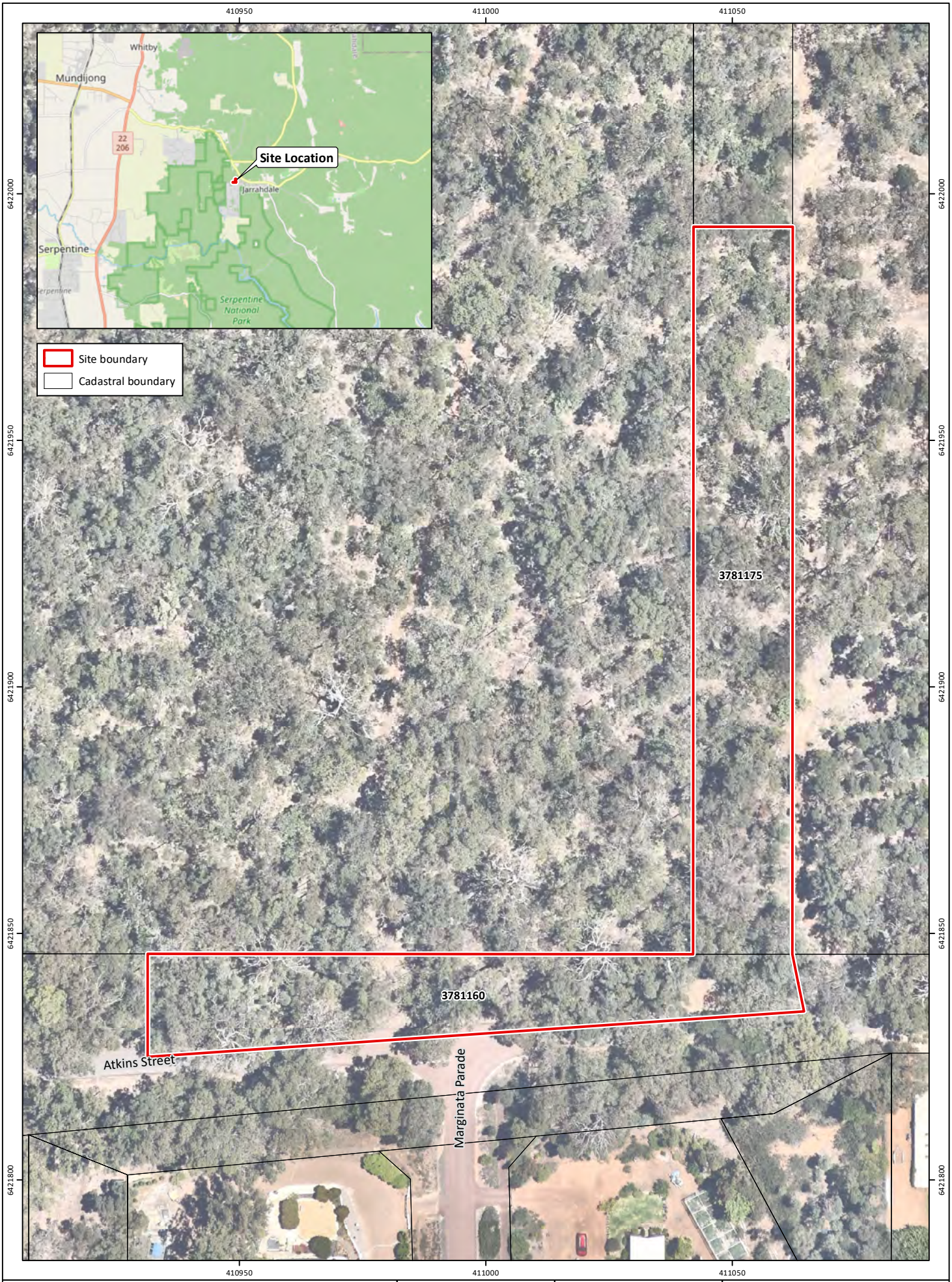

Figure 1: Site Location

Project: Basic Fauna and Targeted Black Cockatoo Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)--F05

Drawn:	GAR	
Date:	07/12/2022	
Checked:	AJU	
Approved:	RAW	
Date:	05/05/2023	

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Metres

Scale: 1:1,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 2: Environmental Features

Project:	Basic Fauna and Targeted Black Cockatoo Assessment Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale
Client:	Shire of Serpentine Jarrahdale

Plan Number:
EP22-113(01)--F06

Drawn:	GAR
Date:	07/12/2022
Checked:	AJU
Approved:	RAW
Date:	05/05/2023

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Metres

Scale: 1:1,000@A4

GDA 1994 MGA Zone 50

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Figure 3: Fauna Habitat

Project:	Basic Fauna and Targeted Black Cockatoo Assessment Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale
Client:	Shire of Serpentine Jarrahdale

Plan Number:
EP22-113(01)--F07

Drawn:	GAR
Date:	07/12/2022
Checked:	AJU
Approved:	RAW
Date:	05/05/2023

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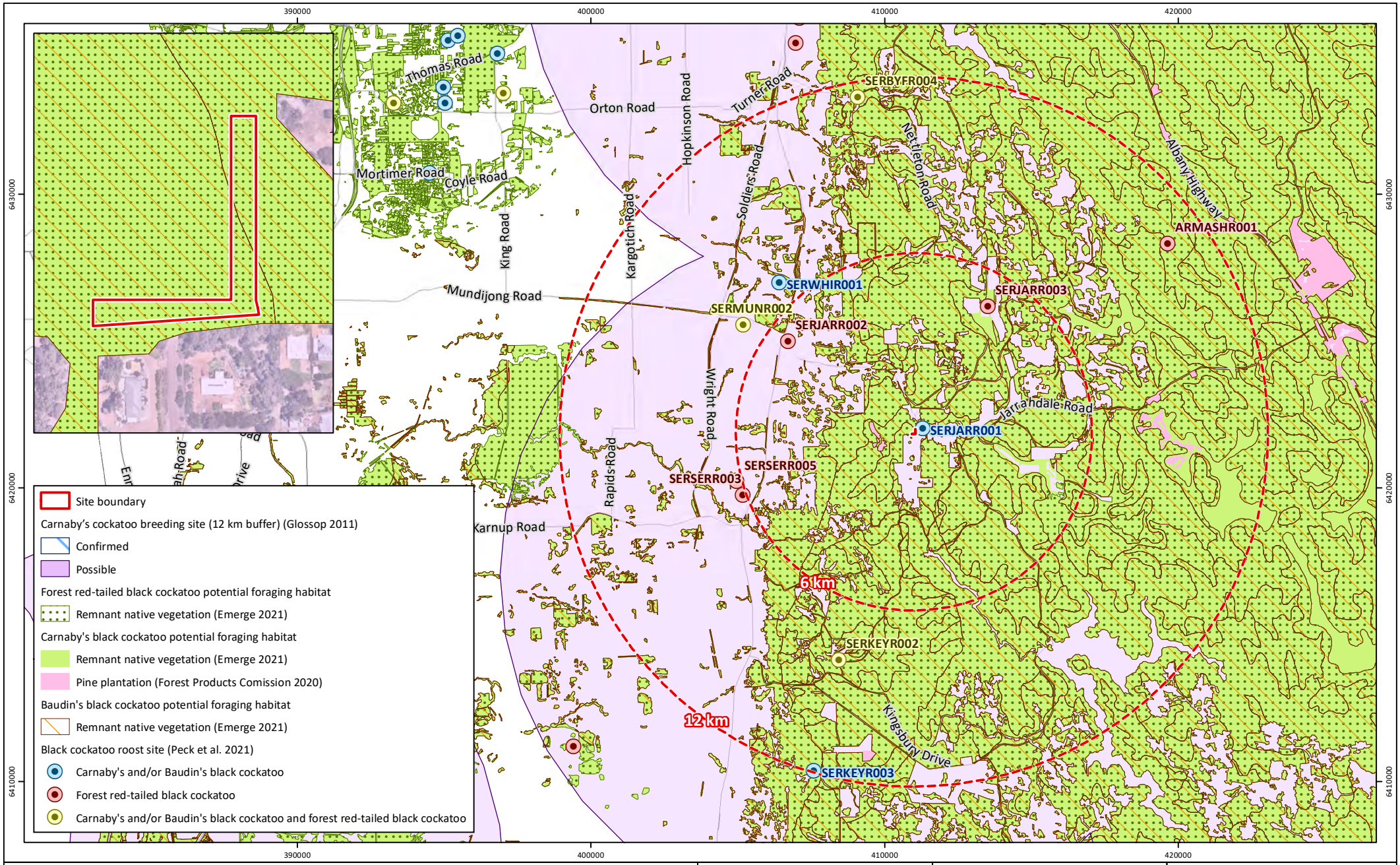

Figure 4: Black Cockatoo Habitat Context

Project: Basic Fauna and Targeted Black Cockatoo Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale
Client: Shire of Serpentine Jarrahdale

Plan Number:
EP22-113(01)--F08

Drawn:	WJC
Date:	07/12/2022
Checked:	AJU
Approved:	RAW
Date:	05/05/2023

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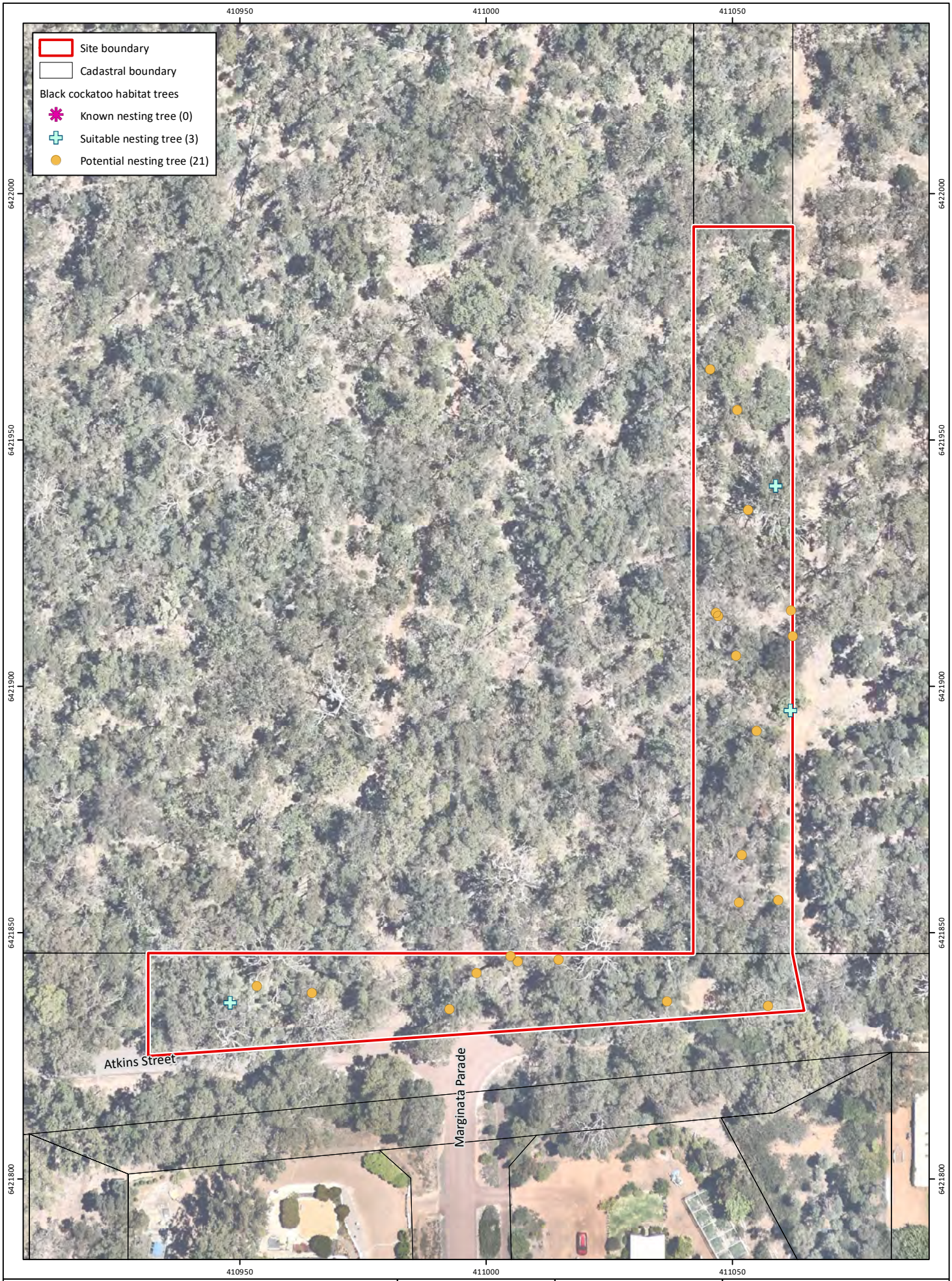

Figure 5: Black Cockatoo Habitat Trees

Project: Basic Fauna and Targeted Black Cockatoo Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)--F09

Drawn:	WJC
Date:	07/12/2022
Checked:	AJU
Approved:	RAW
Date:	05/05/2023

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Metres

Scale: 1:1,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 6: Black Cockatoo Foraging Habitat

Project:	Basic Fauna and Targeted Black Cockatoo Assessment Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale
Client:	Shire of Serpentine Jarrahdale

Plan Number:
EP22-113(01)--F10

Drawn:	WJC
Date:	07/12/2022
Checked:	AJU
Approved:	RAW
Date:	05/05/2023

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Metres

Scale: 1:1,000@A4

GDA 1994 MGA Zone 50

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Appendix A

Additional Information

Flora and Vegetation Report / Fauna Report - Appendix			
Date	**Version**	**Summary of changes**	**Author**
22/05/2020	001	Created appendix from *Emerge Fauna only Report-Appendix A (V010).* Added information regarding black cockatoos	RAW
15/06/2020	002	Added references for Emerge BC datasets and updated State category listings of conservation significant fauna	RAW
19/06/2020	003	Added fauna literature section (previously separate appendix)	MS
17/03/2021	005	Added wetland section	MS
03/12/2021	006	Minor update to black cockatoo section to reference new Emerge foraging habitat spatial datasets	MS
28/01/2021	007	Minor updates to reflect the genus change for Carnaby's and Baudin's cockatoo	MS

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Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as 'threatened', 'migratory' or 'marine' as described in **Table 1**.

Migratory species comprise birds recognised under international treaties including:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)
- China Australia Migratory Bird Agreement 1998 (CAMBA)
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA)
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW[#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR[#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN[#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU[#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory[#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

In Western Australia, fauna taxa may be classed as 'threatened', 'extinct', or 'specially protected' under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019a). The definitions of these categories are provided in **Table 2**.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019a)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild 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. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018b). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those 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 (DBCA 2019a).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 3** (DBCA 2019a).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019a)

Conservation Code	Category
P1	Priority 1 – Poorly known 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.
P2	Priority 2 – Poorly known 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.
P3	Priority 3 – Poorly known 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.
P4	(a) Priority 4 – Rare species 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) Priority 4 – Near Threatened Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain (referred to herein collectively as 'black cockatoos'):

- *Zanda*[1] *latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda*[1] *baudinii* (Baudin's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

There are a range of regional studies and spatial datasets available which provide information on black cockatoo records and potential habitat mapping. These are detailed below.

Species distribution and breeding range

Broad-scale maps are available for the modelled distribution of Baudin's black cockatoo, Carnaby's black cockatoo and forest red-tailed black cockatoo (DSEWPaC 2011; DoEE 2016a, b).

The modelled distribution maps also include 'known breeding areas' and 'predicted breeding range' for Baudin's black cockatoo and 'breeding range' and 'non-breeding range' for Carnaby's black cockatoo.

No breeding range modelling is available for forest red-tailed black cockatoo but the species is known to breed mainly in the jarrah forest region (DBCA 2017a) and in small populations on the Swan Coastal Plain within the Baldivis, Stake Hill, Lake McLarty and Capel area and increasingly in the Perth metropolitan area (DAWE 2020).

Breeding habitat

Department of Environment and Conservation (DEC, now Department of Biodiversity, Conservation and Attractions (DBCA)) and fauna experts, have identified and mapped Carnaby's black cockatoo habitat on the Swan Coastal Plain and Jarrah Forest regions (Glossop *et al.* 2011). This dataset includes mapping of Carnaby's black cockatoo breeding sites based on point records of breeding from a range of sources. Breeding sites were classified as 'confirmed' where eggs or chicks were recorded and 'possible' where observations relating to Carnaby's black cockatoo breeding that did not include actual records of eggs or chicks (e.g. chewed hollows or records of breeding or nesting behaviour by an expert observer).

A 12 km buffer applies to each site to 'reflect the flexible use of these areas by cockatoos and to indicate the important zone for access to potential feeding habitat' (Glossop *et al.* 2011). Glossop *et al.* (2011) state that the areas mapped in the dataset are not a comprehensive record of Carnaby's black cockatoo breeding and that many nesting sites are not known.

While this dataset only applies to Carnaby's black cockatoo, the information it contains is also applicable for Baudin's black cockatoo and forest red-tailed black cockatoo as they have similar

[1] Previously *Calyptorhynchus*

breeding habitat requirements. That is, breeding sites that are suitable for Carnaby's black cockatoo may also be suitable for Baudin's black cockatoo and forest red-tailed black cockatoo, if located within their distribution/breeding ranges.

BirdLife Australia also maintain a database of confirmed black cockatoo breeding sites which is accessible via a paid search system. BirdLife Australia have advised that their database is comprised of data collected during surveys by staff and volunteers of which most (>99%) surveys are of Carnaby's black cockatoo. They have also advised that the dataset is not comprehensive and that an absence of known nests does not necessarily indicate a lack of breeding activity.

The Carnaby's black cockatoo recovery plan also identifies 13 'important bird areas' for Carnaby's black cockatoo, which are identified as 'sites of global bird conservation importance' (DPaW 2013). These 'important bird areas' comprise sites supporting at least 20 breeding pairs or 1% of the population regularly utilising an area in the non-breeding part of the range.

Confirmed roost sites

BirdLife Australia undertakes annual monitoring of black cockatoo overnight roost sites as part of the annual 'Great Cocky Count' community-based survey. Information gathered from these monitoring events provides roost locations and recorded black cockatoo numbers (Peck *et al.* 2019).

Native foraging habitat

Glossop *et al*. (2011) also mapped 'areas requiring investigation as Carnaby's black cockatoo feeding habitat' for the Swan Coastal Plain and Jarrah Forest regions, based on regional vegetation mapping that may contain plant species known to be foraged upon by Carnaby's black cockatoo. Note that this dataset does not include observations or point records of Carnaby's black cockatoo feeding. This dataset represents areas of vegetation that may potentially provide foraging habitat for Carnaby's black cockatoo.

In order to account for clearing of native vegetation that has occurred since the Glossop *et al.* (2011) dataset was created and to incorporate updated vegetation mapping and information on foraging behaviour of Carnaby's black cockatoo, Emerge have revised this dataset to represent the most up to date information available. Furthermore, Emerge have used a similar methodology to Glossop *et al.* (2011) to define potential foraging habitat for Baudin's black cockatoo and forest-red tailed cockatoos.

Specifically, DBCA (2021), DBCA (2019b) and DPIRD (2018) regional vegetation complex mapping was used to determine which areas of remnant vegetation support plant species known to be foraged upon by Carnaby's black cockatoo, Baudin's black cockatoo or forest red-tailed cockatoos. Where these vegetation complexes intersect remnant vegetation mapped by DPIRD (2020) they were considered to represent potential foraging habitat for Carnaby's black cockatoo, Baudin's black cockatoo and/or forest red-tailed cockatoo.

Pine plantations also provide an important food source for Carnaby's black cockatoo, but were not included in the original Glossop *et al.* (2011) dataset. Mapping of pine plantations is available from the Forest Products Commission (Forest Products Commission 2020) and was considered in the assessment of Carnaby's black cockatoo foraging habitat.

Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017b) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**. DBCA maintains a dataset of the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2018a).

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017b)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Literature

The main literature used for identifying fauna and fauna habitats is listed in **Table 8** below.

Table 8: Standard literature used for identifying fauna species and habitats.

Conservation Code	Category
Birds	Johnstone and Storr (1998b), Johnstone and Storr (1998a), Pizzey and Knight (2012), Slater *et al.* (2003)
Mammals	Menkhorst and Knight (2011), Triggs (2003)
Amphibia	Tyler and Doughty (2009), Bush *et al.* (2002)
Reptiles	Bush *et al.* (2002)

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Appendix B

Database Search Results

EPBC Act Protected Matters Report

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

Report created: 16-Nov-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	17
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	3
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Peel-yalgorup system	30 - 40km upstream from Ramsar site

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Zanda baudinii listed as Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Roosting known to occur within area
Zanda latirostris listed as Calyptorhynchus latirostris		
Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area
MAMMAL		
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
OTHER		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat may occur within area
PLANT		
Anthocercis gracilis		
Slender Tailflower [11103]	Vulnerable	Species or species habitat may occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Lasiopetalum pterocarpum		
Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
[Thelymitra stellata](#) Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Gooralong	Conservation Park	WA
Serpentine	National Park	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State
South West WA RFA	Western Australia

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact us page.

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Naturemap results - 10km radius
20 Champion Road, Lesmurdie

Category	Status	Taxon
BIRD	CD	Cacatua pastinator pastinator
	CR	Calidris ferruginea
	EN	Calyptorhynchus baudinii
	EN	Calyptorhynchus latirostris
	EN	Calyptorhynchus sp. 'white-tailed black cockatoo'
	MI	Actitis hypoleucos
	MI	Calidris ruficollis
	MI	Hydroprogne caspia
	MI	Plegadis falcinellus
	MI	Tringa nebularia
	OS	Falco peregrinus
	P4	Oxyura australis
	VU	Calyptorhynchus banksii naso
	VU	Leipoa ocellata
FISH	P3	Geotria australis
INVERTEBRATE	P3	Euoplos inornatus
	P3	Glacidorbis occidentalis
	P3	Idiosoma sigillatum
	VU	Westralunio carteri
MAMMAL	CD	Phascogale tapoatafa wambenger
	CR	Bettongia penicillata ogilbyi
	CR	Pseudocheirus occidentalis
	EN	Myrmecobius fasciatus
	P4	Falsistrellus mackenziei
	P4	Hydromys chrysogaster
	P4	Isoodon fusciventer
	P4	Notamacropus eugenii derbianus
	P4	Notamacropus irma
	VU	Dasyurus geoffroii
	VU	Setonix brachyurus
REPTILE	P3	Acanthophis antarcticus
	P4	Ctenotus delli

Appendix C

Black Cockatoo Foraging Plants

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Acacia baileyana	Cootamundra wattle	Secondary	-	-	Groom 2011
Acacia pentadenia	Karri wattle	Secondary	-	-	Groom 2011
Acacia saligna	Orange wattle	Secondary	-	-	Groom 2011
Agonis flexuosa	Peppermint tree	Secondary	-	-	Groom 2011
Allocasuarina fraseriana	Sheoak	-	Secondary	Secondary	Johnstone & Storr 1998; Johnstone *et al.* 2010; Johnstone 2017; DoEE 2017
Allocasuarina spp.		Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Anigozanthos flavidus	Tall kangaroo paw	-	Secondary	-	Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Araucaria heterophylla	Norfolk island pine	Secondary	-	-	Groom 2011; DoEE 2017
Banksia ashbyi	Ashby's banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia attenuata	Slender banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia baxteri	Baxter's banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia carlinoides	Pink dryandra	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia coccinea	Scarlet banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia dallanneyi	Couch honeypot dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia ericifolia	Heath-leaved banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia fraseri		Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia gardneri	Prostrate banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia grandis	Bull banksia	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia hookeriana	Hooker's banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia ilicifolia	Holly banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
Banksia kippistiana		Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia leptophylla		Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia lindleyana	Porcupine banksia	Primary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Banksia littoralis	Swamp banksia	Primary	Secondary	-	Saunders 1980; Groom 2011Johnstone & Storr 1998; Johnstone *et al.* 2010; DoEE 2017
Banksia menziesii	Firewood banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia mucronulata	Swordfish dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia nivea	Honeypot dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia nobilis	Golden dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia praemorsa	Cut-leaf banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia prionotes	Acorn banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia prolata		Primary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Banksia quercifolia	Oak-leaved banksia	Primary	Secondary	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia sessilis	Parrot bush	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia speciosa	Showy banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia spp.		Primary	Secondary	-	Saunders 1979; DSEWPaC 2012; DoEE 2017
Banksia squarrosa	Pingle	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia tricuspis	Pine banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia undata	Urchin dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia verticillata	Granite banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Brassica campestris	Canola	Secondary	-	-	Groom 2011; DoEE 2017
Callistemon spp.		Secondary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Callistemon viminalis	Captain cook bottlebrush	Secondary	-	-	Groom 2011
Callitris sp.		Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Carya illnoinensis	Pecan	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; Groom 2014; DoEE 2017
Casuarina cunninghamiana	River sheoak	Secondary	-	-	Groom 2011
Citrullus lanatus	Pie or afghan melon	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Corymbia calophylla	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
Corymbia citriodora	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone *et al.* 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
Corymbia ficifolia	Red flowering gum	Secondary	-	-	Groom 2011
Corymbia haematoxylon	Mountain marri	Secondary	-	Secondary	Groom 2011; DoEE 2012; DoEE 2017
Corymbia maculata	Spotted gum	-	-	-	-
Darwinia citriodora	Lemon-scented darwinia	Secondary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Diospryros sp.	Sweet persimmon	Secondary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eremophila glabra	Tarbush	Secondary	-	-	Groom 2011
Erodium aureum		Secondary	-	-	Groom 2011
Erodium botrys	Long storksbill	Secondary	Secondary	-	Groom 2011; Johnstone & Storr 1998; Johnstone *et al.* 2010
Erodium spp.		Secondary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Eucalyptus caesia	Silver princess	Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
Eucalyptus camaldulensis	River red gum	-	-	Secondary	DoEE 2012; DoEE 2017
Eucalyptus decipiens	Red heart/moit	-	-	Secondary	Johnstone 2017
Eucalyptus diversicolor	Karri	-	-	Primary	Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
Eucalyptus erythrocorys	Illyarrie	Secondary	-	Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone *et al.* 2010
Eucalyptus gomphocephala	Tuart	Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus grandis	Flooded gum, rose gum	-	-	Secondary	DoEE 2012; DoEE 2017
Eucalyptus lehmannii	Bushy yate	-	-	Secondary	Johnstone 2017
Eucalyptus leucoxylon	Yellow gum	Secondary	-	-	Groom 2014

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Eucalyptus loxophleba	York gum	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus marginata	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
Eucalyptus patens	Blackbutt	Primary	-	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
Eucalyptus pleurocarpa	Tallerack	Secondary	-	-	Groom 2011
Eucalyptus preissiana	Bell-fruited mallee	Secondary	-	-	Groom 2011
Eucalyptus robusta	Swamp mahogany	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Eucalyptus salmonophloia	Salmon gum	Primary	-	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
Eucalyptus staeri	Albany blackbutt	-	-	Secondary	Johnstone & Storr 1998
Eucalyptus todtiana	Coastal blackbutt	Secondary	-	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; Johnstone & Kirkby 2008
Eucalyptus wandoo	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone *et al* . 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Ficus sp.	Fig	Secondary	-	-	Groom 2011
Grevillea armigera	Prickly toothbrushes	Primary	-	-	Groom 2011
Grevillea bipinnatifida	Fuschia grevillea	Primary	-	-	Groom 2011
Grevillea hookeriana	Red toothbrushes	Primary	-	-	Groom 2011
Grevillea hookeriana subsp. api	Black toothbrushes	Primary	-	-	Groom 2011
Grevillea paniculata	Kerosene bush	Primary	-	-	Groom 2011
Grevillea paradoxa	Bottlebrush grevillea	Primary	-	-	Groom 2011
Grevillea petrophiloides	Pink poker	Primary	-	-	Groom 2011
Grevillea robusta	Silky oak	Primary	-	-	Johnstone *et al.* 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Grevillea spp.		Primary	-	-	Saunders 1979; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Grevillea wilsonii	Native fuchsia	-	Secondary	-	Johnstone *et al.* 2010
Hakea auriculata		Primary	-	-	Saunders 1980; Groom 2011
Hakea candolleana		Primary	-	-	Groom 2011
Hakea circumalata	Coastal hakea	Primary	-	-	Groom 2011
Hakea commutata		Primary	-	-	Groom 2011
Hakea conchifolia	Shell-leaved hakea	Primary	-	-	Groom 2011
Hakea costata	Ribbed hakea	Primary	-	-	Groom 2011
Hakea cristata	Snail hakea	Primary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Hakea cucullata	Snail hakea	Primary	-	-	Groom 2011
Hakea cyclocarpa	Ramshorn	Primary	-	-	Saunders 1980; Groom 2011
Hakea eneabba		Primary	-	-	Groom 2011
Hakea erinacea	Hedgehog hakea	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Hakea falcata	Sickle hakea	Primary	-	-	Groom 2011
Hakea flabellifolia	Fan-leaved hakea	Primary	-	-	Groom 2011
Hakea gilbertii		Primary	-	-	Saunders 1980; Groom 2011
Hakea incrassata	Golfball or marble hakea	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Hakea lasiantha	Woolly flowered hakea	Primary	-	-	Johnstone *et al* . 2010; Groom 2011
Hakea lasianthoides		Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Hakea laurina	Pin-cushion hakea	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Hakea lissocarpha	Honeybush	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea marginata		-	Secondary	-	Johnstone *et al.* 2010
Hakea megalosperma	Lesueur hakea	Primary	-	-	Groom 2011
Hakea multilineata	Grass leaf hakea	Primary	-	-	Groom 2011
Hakea neospathulata		Primary	-	-	Groom 2011
Hakea obliqua	Needles and corks	Primary	-	-	Saunders 1980; Groom 2011
Hakea oleifolia	Dungyn	Primary	-	-	Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Hakea pandanicarpa subsp. crassifolia	Thick-leaved hakea	Primary	-	-	Groom 2011
Hakea petiolaris	Sea urchin hakea	Primary	-	-	Groom 2011
Hakea polyanthema		Primary	-	-	Groom 2011
Hakea preissii	Needle tree	Primary	-	-	Groom 2011
Hakea prostrata	Harsh hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea psilorrhyncha		Primary	-	-	Groom 2011
Hakea ruscifolia	Candle hakea	Primary	Secondary	-	Saunders 1980; Groom 2011; Johnstone *et al.* 2010
Hakea scoparia	Kangaroo bush	Primary	-	-	Groom 2011
Hakea smilacifolia		Primary	-	-	Groom 2011
Hakea spp.		Primary	Secondary	-	Saunders 1979; DSEWPaC 2012; DoEE 2017
Hakea stenocarpa	Narrow-fruited hakea	Primary	Secondary	-	Johnstone et al. 2010; Groom 2011
Hakea sulcata	Furrowed hakea	Primary	-	-	Groom 2011
Hakea trifurcata	Two-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea undulata	Wavy-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea varia	Variable-leaved hakea	Primary	Secondary	-	Saunders 1980; Groom 2011
Harpephyllum caffrum	Kaffir plum	-	-	Secondary	Johnstone 2017
Helianthus annuus	Sunflower	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Hibiscus sp.	Hibiscus	Secondary	-	-	Groom 2011
Isopogon scabriusculus		Secondary	-	-	Groom 2011
Jacaranda mimosifolia	Jacaranda	Secondary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Jacksonia furcellata	Grey stinkwood	Secondary	-	-	Groom 2011
Kingia australis	Kingia	-	Secondary	-	Johnstone *et al.* 2010
Lambertia inermis	Chittick	Secondary	-	-	Johnstone & Storr 1998; Groom 2011
Lambertia multiflora	Many-flowered honeysuckle	Secondary	-	-	Saunders 1980; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Liquidamber styraciflua	Liquid amber	Primary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; Groom 2014; Personal observation
Lupinus sp.	Lupin	Secondary	-	-	Saunders 1980; Groom 2011
Macadamia integrifolia	Macadamia	Primary	Secondary	-	Johnstone *et al.* 2010; Grooms 2011; Groom 2014
Malus domestica	Apple	Secondary	Secondary	-	Johnstone *et al* . 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
Melaleuca leuropoma		Secondary	-	-	Saunders 1980; Groom 2011
Melia azedarach	Cape lilac or white cedar	Secondary	-	Primary	Johnstone *et al.* 2010; Groom 2011
Mesomeleana spp.		Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Olea europea	Olive	-	-	Secondary	Johnstone 2017
Persoonia longifolia	Snottygobble	-	-	Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Pinus canariensis	Canary island pine	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Pinus caribea	Caribbean pine	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Pinus pinaster	Pinaster or maritime pine	Primary	-	-	Groom 2011
Pinus radiata	Radiata pine	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Pinus spp.		Primary	Secondary	-	Johnstone & Storr 1998; Saunders 1979; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Protea 'Pink Ice'		Secondary	-	-	Groom 2011
Protea repens		Secondary	-	-	Groom 2011
Protea spp.		Secondary	-	-	Johnstone *et al.* 2010
Prunus amygdalus	Almond tree	Secondary	-	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Pyrus communis	European pear	-	Secondary	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Quercus spp.	Oak	-	Secondary	-	Johnstone *et al.* 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Raphanus raphanistrum	Wild radish	Secondary	-	-	Groom 2011; DoEE 2017
Reedia spathacea		-	Secondary	-	Johnstone *et al.* 2010
Rumex hypogaeus	Doublegee	Secondary	-	-	Saunders 1980
Stenocarpus sinuatus		Secondary	-	-	Johnstone *et al.* 2010
Syzygium smithii	Lilly pilly	Secondary	-	-	Groom 2014
Tipuana tipu	Tipu or rosewood tree	Primary	-	-	Groom 2011, Groom 2014
Xanthorrhoea preissii	Grass tree	Secondary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Xylomelum occidentale	Woody pear	Secondary	-	-	Groom 2014

CBC=Carnaby's black cockatoo, BBC=Baudin's black cockatoo and FRTBC=Forest red-tailed black cockatoo

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Appendix D

Conservation Significant Species and Likelihood of Occurrence Assessment

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
Actitis hypoleucos	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone & Storr 1998).	**Unlikely** No suitable habitat occurs in this site**.**
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	**Possible** May opportunistically occur in or fly over the site on commute or while searching for prey.
Cacatua pastinator pastinator	Muir's corella	CD	-	Wheat and sheep farming country with remnant native forest. Species is restricted to the south-west corner of WA, near Lake Muir (DPaW 2015).	**Unlikely** Species distribution restricted further south west of WA**.**
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh, brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields.	**Unlikely** No suitable habitat occurs in this site**.**
Calidris ferruginea	Curlew sandpiper	CR	CR (MI)	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds.	**Unlikely** No suitable habitat occurs in this site**.**

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris melanotos	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	**Unlikely** No suitable habitat occurs in this site**.**
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	**Unlikely** No suitable habitat occurs in this site.
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azedarach and Eucalyptus spp. trees.	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	**Possible** May opportunistically occur in or fly over the site on commute or while searching for prey.
Leipoa ocellata	Malleefowl	VU	VU	Scrubs and thickets of Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	**Unlikely** No suitable habitat occurs in this site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Motacilla cinerea	Grey wagtail	MI	MI	In Australia mostly near running water in disused quarries, sandy and rocky streams in escarpments and rainforests, sewage ponds, ploughed fields and airfields (Pizzey & Knight 2012).	**Unlikely** No suitable habitat occurs in this site.
Numenius madagascariensis	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	**Unlikely** No suitable habitat occurs in this site.
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	**Unlikely** No suitable habitat occurs in this site.
Tyto novaehollandiae novaehollа	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	**Unlikely** No suitable habitat occurs in this site.
Zanda baudinii	Baudin's black cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	**Likely** Suitable foraging and roosting habitat occurs in the site and within current distribution.
Invertebrates					
Euoplos inornatus	Inornate trapdoor spider	P3	-	Has previously been recorded in jarrah forest, including near clay banks and granite outcrop. Most records are from the Darling scarp/Jarrah Forest Region, with limited records from the Swan Coastal Plain (DBCA 2020).	**Possible** Suitable habitat and within species distribution. Previous records nearby
Glacidorbis occidentalis	-	P3	P3	Found in freshwater streams in Jarah forests in the edges of the Darling Ranges (Bunn & Stoddard 1988)	**Unlikely** No suitable habitat occurs in this site.
Idiosoma sigillatum	Swan Coastal Plain shield-backed	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	**Unlikely** Occurs on Swan Coastal Plain
Westralunio carteri	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Also occupies lentic systems including large water supply dams and even on-stream farm dams. Salinity tolerance quite low (Morgan et al. 2011).	**Unlikely** No suitable habitat occurs in this site.

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Mammals					
Bettongia penicillata ogilbyi	Woylie	CR	EN	Woodlands and adjacent heaths with a dense understorey of shrubs, particularly Gastrolobium spp. (TSSC 2018).	**Unlikely** Outside of species distribution
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012b).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south-west (Christensen et al. 1985).	**Unlikely** No suitable habitat occurs in this site.
Isodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	**Likely** Suitable habitat (woodland/forest) occurs in the site.
Myrmecobius fasciatus	Numbat	EN	EN	Generally dominated by Eucalyptus spp. that provide hollow logs and branches for shelter and termites for food (van Dyck & Strahan 2008).	**Unlikely** All records historical. Current distributuon restricted to further South

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Notamacropus irma	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Petropseudes dahli	Rock ringtail possum	P3	-	Rocky escarpment country with eucalypt woodland or vine forest thickets (Menkhorst & Knight 2011). Occurs in Kimberley	**Unlikely** Outside of species distribution
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Potorous gilbertii	Gilbert's potoroo	CR	CR	Dense Melaleuca heath with dense groundcover of sedges (Menkhorst & Knight 2011).	**Unlikely** No suitable habitat occurs in this site.
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Setonix brachyurus	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Trichosurus vulpecula arnhemensis	Northern brushtail possum	VU	-	Distributed across top end and Kimberley region.	**Unlikely** Outside of species distribution

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Wyulda squamicaudata	Scaly-tailed possum	P4	-	Low open woodland, riparian forest and vine thickets where tumbled boulderss provide shelter. Patchily distributed in coastal North-western kimberley (Menkhorst & Knight 2011)	**Unlikely** Outside of species distribution
Reptiles					
Acanthophis antarcticus	Southern death adder	P3	-	Mostly in woodlands, grasslands and heaths. In the Darling Range this species is typically found within Eucalyptus marginata woodlands adjacent to granite outcrops and along densely vegetated creeks (Bush et al. 2007).	**Possible** Suitable habitat (woodland/forest) occurs in the site.
Ctenotus delli	Dell's skink	P4	-	Jarrah and marri woodland with a shrub dominated understorey, sheltering in dense vegetation, inside grass trees and beneath rocks, sometimes in burrows (Nevill 2005).	**Possible** Suitable habitat (woodland/forest) occurs in the site.

Note: CE=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species recorded or considered to potentially occur within the site are shaded green.

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Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Western Australia, SERCUL, Perth, Western Australia.					

Appendix E

Species List

Fauna List
Lot 3781175 and 3781160 (Atkins Street) Jarrahdale

Category	Status	Species name	Common name	Record type
Birds	VU	*Calyptorhynchus banksia naso*	Forest red-tailed black cockatoo	Foraging evidence
		Dacelo novaeguineae	Laughing kookaburra	Call
		Barnardius zonarius	Australian ringneck	Sight
		Cracticus tibicen	Australian magpie	Sight
		Corvus coronoides	Australian raven	Sight
		Eolophus roseicapilla	Gallah	Sight
Mammals	DP	*Oryctolagus cuniculus*	Rabbit	Diggings
		Macropus fuliginosus	Western grey kangaroo	Scat

Note: DP=declared pest under the BAM Act, EN=Endangered under the EPBC Act, P4=Priority 4 in WA

Appendix F

Black Cockatoo Habitat Tree Data

Tag No.	Easting	Northing	DBH (cm)	Species	BC Hollow Category	Recorder
428	411059.33	6421856.60	52	*Corymbia calophylla*	Potential nesting tree	SKP
429	411052.00	6421865.74	102	Corymbia calophylla	Potential nesting tree	SKP
430	411051.43	6421856.09	82	*Corymbia calophylla*	Potential nesting tree	SKP
431	411057.35	6421835.08	60	*Corymbia calophylla*	Potential nesting tree	SKP
432	411054.98	6421890.93	63	*Eucalyptus marginata*	Potential nesting tree	SKP
433	411061.81	6421894.98	73	*Corymbia calophylla*	Suitable nesting tree	SKP
434	411050.80	6421906.19	54	*Eucalyptus marginata*	Potential nesting tree	SKP
435	411062.34	6421910.18	58	*Corymbia calophylla*	Potential nesting tree	SKP
436	411047.15	6421914.25	74	*Corymbia calophylla*	Potential nesting tree	SKP
437	411062.01	6421915.38	54	*Eucalyptus marginata*	Potential nesting tree	SKP
438	411046.77	6421914.92	92	*Corymbia calophylla*	Potential nesting tree	SKP
439	411053.26	6421935.82	110	*Eucalyptus marginata*	Potential nesting tree	SKP
440	411058.87	6421940.74	163	*Eucalyptus marginata*	Suitable nesting tree	SKP
441	411051.01	6421956.08	57	*Corymbia calophylla*	Potential nesting tree	SKP
442	411045.58	6421964.35	51	*Eucalyptus marginata*	Potential nesting tree	SKP
443	411036.73	6421836.00	54	Eucalyptus marginata	Potential nesting tree	SKP
444	411014.73	6421844.46	51	*Corymbia calophylla*	Potential nesting tree	SKP
445	411006.45	6421844.16	58	*Corymbia calophylla*	Potential nesting tree	SKP
446	411005.03	6421845.15	78	*Corymbia calophylla*	Suitable nesting tree	SKP
447	410998.09	6421841.76	92	*Eucalyptus marginata*	Potential nesting tree	SKP
448	410992.60	6421834.39	54	*Corymbia calophylla*	Potential nesting tree	SKP
449	410964.62	6421837.70	83	*Eucalyptus marginata*	Potential nesting tree	SKP
450	410948.07	6421835.78	133	*Eucalyptus marginata*	Potential nesting tree	SKP
451	410953.50	6421839.04	113	*Eucalyptus marginata*	Potential nesting tree	SKP

Habitat Trees

Land ID numbers 3781175 and 3781160
(Atkins Street) Jarrahdale

Tree ID	Photo	Tree ID	Photo
428		434	
429		435	
430		436	

Habitat Trees

Land ID numbers 3781175 and 3781160
(Atkins Street) Jarrahdale

Tree ID	Photo
437	
438	
439	
440	
441	
442	

Habitat Trees

Land ID numbers 3781175 and 3781160
(Atkins Street) Jarrahdale

Tree ID	Photo	Tree ID	Photo
443		446	
444		447	
445		448	

Habitat Trees

Land ID numbers 3781175 and 3781160
(Atkins Street) Jarrahdale

Tree ID	Photo	Tree ID	Photo
449			
450			
451