

Basic and Targeted Fauna Survey

Lot 2919 Rosa Brook Rd, Rosa Brook

DECEMBER 2020



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CONTENTS

EXECUTIVE SUMMARY	A-6
1 INTRODUCTION	8
1.1 BACKGROUND.....	8
1.2 SCOPE OF WORK.....	8
1.3 REGULATORY CONTEXT	9
1.3.1 Key legislation	9
1.3.2 Fauna	9
2 METHODS	11
2.1 DESKTOP STUDY.....	11
2.1.1 Previous surveys.....	12
2.1.2 Publications.....	12
2.1.3 Taxonomy and nomenclature.....	12
2.2 FIELD SURVEYS.....	12
2.2.1 General habitat assessment and opportunistic recordings	13
2.2.2 Black cockatoos	13
2.2.3 Camera traps	15
2.3 LIMITATIONS.....	15
3 DESKTOP STUDY	17
3.1 LOCAL AND REGIONAL CONTEXT	17
3.1.1 Land use	17
3.1.2 Interim Biogeographic Regionalisation of Australia (IBRA) values	17
3.1.3 DBCA managed lands	17
3.1.4 Habitat connectivity, linkage, or corridor values.....	18
3.1.5 Important Bird Areas (IBA)	18
3.2 ENVIRONMENTAL VALUES OF THE STUDY AREA.....	18
3.2.1 Climate, landform and soils	18
3.2.2 Wetlands and watercourses	19
3.2.3 Vegetation	20
3.3 POTENTIAL FAUNA RECORDS.....	20
3.3.1 Fauna recorded locally.....	20
3.3.2 Fauna of conservation significance	21

4	RESULTS	23
4.1	FAUNA HABITAT	23
4.1.1	General fauna habitat	23
4.1.2	Suitable DBH trees and hollows.....	25
4.2	FAUNA RECORDED	25
4.3	FAUNA OF CONSERVATION SIGNIFICANCE	26
5	SPECIES PROFILES AND SITE VALUES.....	28
5.1.2	Black cockatoos	34
6	CONCLUSIONS AND RECOMMENDATIONS.....	37
7	REFERENCES.....	39
APPENDIX A	FIGURES	A-1
APPENDIX B	CONSERVATION CODES.....	B-2
APPENDIX C	POTENTIAL FAUNA LIST AND FAUNA RECORDED	C-3
APPENDIX D	NATUREMAP AND PMST DATABASE RESULTS.....	D-1
APPENDIX E	THREATENED FAUNA EVALUATION.....	E-2
APPENDIX F	SUITABLE DBH TREES	F-16

[Figures](#)

Figure 1 Locality	A-1
Figure 2 Study area.....	A-1
Figure 3 Fauna survey effort	A-1
Figure 4 Fauna habitat types	A-1
Figure 5 Suitable DBH trees and trees with hollows	A-1
Figure 6 Black cockatoo breeding likelihood	A-1

[Photos](#)

Photo 1 Cleared	23
Photo 2 Revegetated shrubland and Open water.....	24
Photo 3 Jarrah and Marri open forest.....	24
Photo 4 Bullich and Blackbutt open woodland through the drainage line.	24
Photo 5 Potential hollow with possible chews.	36
Photo 6 Black cockatoo feed residue	37

Tables

Table 1-1 Environmental legislation that may be relevant to the Project	9
Table 2-1 Fauna habitat quality categories and descriptions (SW Environmental, undated).....	13
Table 2-2 Limitations of survey adequacy and accuracy.....	15
Table 3-1 Threatened and Priority fauna recorded, or that may occur, within 10 km of the study area (Naturemap, 2020) (PMST, 2020).....	21
Table 4-2 Fauna recorded within the study area	25
Table 4-3 Conservation significant fauna that may occur within the study area, based on habitat suitability.....	27
Table 5-1 Summary of hollow attributes across the study area.....	36
Table 7-1 Suitable DBH trees and hollows within the study area.....	F-17

Common terms/acronyms

BC Act	WA Biodiversity Conservation Act 2016
DAWE	Federal Department of Agriculture, Water and the Environment
DBCA	WA Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height in centimetres
DWER	WA Department of Water and Environmental Regulation
EP Act	WA Environmental Protection Act 1986
EPBC Act	Federal Environment Protection and Biodiversity Conservation Act 1999
FRTBC	Forest Red-tailed Black Cockatoo
Project	The proposed action
Proposal area / site	The Project extent as provided by the client
Study area	A 10 km buffer around the proposal area
Suitable DBH tree	Tree of a suitable size to develop large hollows (>50cm DBH).
WA	Western Australia

Executive summary

Papillion Holdings Pty Ltd, the owner of Lot 2919 on Deposited Plan 203096, Rosa Brook is proposing to construct two dams along an unnamed tributary of the Margaret River (northern dam), and along the Mowen River (southern dam). The dam footprints are approximately 4.67 ha and 2.03 ha for the northern and southern dams, respectively. Clearing of native vegetation will be required for both dams, 2.03 ha for the northern dam and 3.08 ha for the southern dam.

The clearing will require a clearing permit under the *Environmental Protection Act 1986* (EP Act). The project may also warrant referral to Department of Agriculture, Water and the Environment (DAWE) for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A Basic and Targeted vertebrate fauna survey was required to inform the Clearing Permit assessment and guide the proponent in terms of their obligations under the EPBC Act.

The scope of survey included a vertebrate fauna survey (Basic) and Targeted survey for black cockatoos, in accordance with EPA Technical Guidance (EPA 2020¹) and other relevant State and Commonwealth guidelines. The surveys also identified if any Matters of National Environmental Significance (EPBC Act) are present within the area.

The intent of the field surveys were to validate the desktop assessment, document habitat types and quality, and record any vertebrate fauna observed. Targeted black cockatoo surveys were also conducted.

A total of 143 terrestrial species have been recorded locally, with birds by far the most abundant class. Based on the evaluation provided in Appendix D, there are 16 vertebrate fauna of conservation significance that may occur locally (not necessarily within the study area). Additionally, three fish and four invertebrates of conservation significance may also potentially occur locally

Five key fauna habitat types were identified:

- Open water (dam) (0.46 ha including existing dams) – Low fauna habitat quality.
- Cleared ha (0.15 ha) - Low fauna habitat quality.
- Revegetated shrubland (0.27 ha) - Low fauna habitat quality.
- Jarrah and Marri open forest (2.16 ha) – High fauna habitat quality.
- Bullich and Blackbutt open woodland through the drainage line (2.35 ha) – High fauna habitat quality.

Thirty-six species of fauna were observed within the study area. The fauna recorded included 28 birds, four mammals, one of which is a pest species (Rabbit), two frogs and one reptile. Most are common species, with the exceptions of the black cockatoos, Quokka (possible) and Water rat (possible record) which are species of conservation significance. The initial site visit identified that the study area, in particular the southern dam site, may contain habitat for Quokka and possible evidence of use (runnels and scat). Eight camera traps (20 MP infrared motion sensing cameras) baited with universal bait and

¹ Environmental Protection Authority (2020) Technical Guidance – Terrestrial Guidance for Fauna Surveys for Environmental Impact Assessment. Perth, Western Australia.

apple, were positioned across the study area, three at the northern site and five in the southern site, under SW Environmental's Section 40 (TFA 2020-0150) license. The cameras targeted natural clearings, corridors, and other sites likely to be used by native fauna. The cameras were installed for approximately three weeks (176 trap days). No Quokka or other conservation significant fauna were recorded by the camera traps.

All three black cockatoos were recorded (Carnaby's and FRTBC observed directly and Baudin's from feed residue). There was no evidence of roosts observed at the either dam site.

There were a total of 131 suitable DBH trees (i.e. Dead, Jarrah, Marri, or Bullich >50cm DBH) within the study area that may develop hollows in the medium to longer term.

Eight trees (three trees within the northern site, and five within the southern site), had potential to be used by black cockatoos for breeding based on typical black cockatoo breeding hollow attributes such as orientation, access, chamber size or use by other animals. None showed any characteristics that would indicate recent or older use (chews). The possible exception was tree ID149 that had some possible chews around the rim of a potential hollow but there is a high chance that the flaking of bark could be natural as the hollow does not appear to be well developed.

The following recommendations are made:

- Clearing should be conducted outside of spring to minimise impacts to breeding fauna.
- A licensed fauna spotter should be on site during the clearing, particularly during the clearing of hollow trees.
- Large hollows should be rechecked prior to clearing (within one week) to confirm that no black cockatoos are breeding.
- Large or hollow trees that occur on the dam edge should be retained where possible.
- The final impact footprints should be checked against the significant impact criteria (DEWHA 2013; SEWPAC 2012) for black cockatoos and other matters of NES to determine the need to refer the project to DAWE. It is noted that it is the proponent's responsibility to refer the action for legal certainty.

1 Introduction

1.1 Background

Papillion Holdings Pty Ltd, the owner of Lot 2919 on Deposited Plan 203096, Rosa Brook is proposing to construct two dams along an unnamed tributary of the Margaret River (northern dam), and along the Mowen River (southern dam). The location of proposed dams (herein referred to as the study area) are shown in Figures 1 and 2 (Appendix A).

The dam footprints are approximately 4.67 ha and 2.03 ha for the northern and southern dams, respectively. Clearing of native vegetation will be required for both dams, 2.03 ha for the northern dam and 3.08 ha for the southern dam.

The clearing will require a clearing permit under the *Environmental Protection Act 1986* (EP Act). The project may also warrant referral to Department of Agriculture, Water and the Environment (DAWE) for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A Basic and Targeted vertebrate fauna survey was required to inform the Clearing Permit assessment and guide the proponent in terms of their obligations under the EPBC Act.

1.2 Scope of work

The scope of survey includes the following for the study area (both dam clearing footprints):

- Vertebrate fauna survey (Basic) and Targeted survey for black cockatoos, in accordance with EPA Technical Guidance (EPA 2020²) and other relevant State and Commonwealth guidelines. The surveys will also identify whether any Matters of National Environmental Significance (EPBC Act) are present within the area.

The surveys include

- Desktop assessment,
- Field validation and habitat assessment,
- Consultation, reporting, mapping, and recommendations.

² Environmental Protection Authority (2020) Technical Guidance – Terrestrial Guidance for Fauna Surveys for Environmental Impact Assessment. Perth, Western Australia.

1.3 Regulatory context

1.3.1 Key legislation

Key environmental legislation that may be relevant to the fauna survey is outlined in Table 1-1.

Table 1-1 Environmental legislation that may be relevant to the Project

Legislation	Responsible Government Department	Aspect
<i>Federal Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Federal Department of Agriculture, Water and the Environment (DAWE)	Matters of National Environmental Significance including threatened fauna and environmental offsets.
<i>Biodiversity Conservation Act 2016</i> (BC Act)	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Threatened species habitats, threatening processes, environmental pests and weeds.
<i>Biosecurity and Agricultural Management Act 2007</i> (BAM Act)	WA Department of Primary Industries and Regional Development	Weeds, feral animals and other pests.
<i>Environmental Protection Act 1986</i> (EP Act)	Environmental Protection Authority or DWER	Environmental impact assessment and management and offsets.

1.3.2 Fauna

Western Australian (WA) fauna may be afforded protection under the BC Act and or federal EPBC Act.

Species listed as threatened or migratory under the above legislation are referred to collectively in this document as being 'conservation significant' or 'target' species. These terms include species listed under the DBCA Priority lists.

BC Act

The WA BC Act and associated Regulations provide for the licensing and management of activities that affect biodiversity. The BC Act provides for the listing of threatened native animals (fauna) that need protection as critically endangered, endangered or vulnerable species.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* contain the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act. These are described below.

Threatened species

- CR: Critically endangered species
- EN: Endangered species
- VU: Vulnerable species

Extinct species

- EX: Extinct species
- EW: Extinct in the wild species

Specially protected species

- MI: Migratory species
- CD: Species of special conservation interest (conservation dependent fauna)
- OS: Other specially protected species

Priority species

- Priority 1: Poorly-known species
- Priority 2: Poorly-known species
- Priority 3: Poorly-known species
- Priority 4: Rare, Near Threatened and other species in need of monitoring

A full description of conservation codes is provided in Appendix B.

EPBC Act

In accordance with Commonwealth legislation, the EPBC Act provides a list of 'Matters of National Environmental Significance' (NES), which includes significant fauna, flora, and communities. Under the EPBC Act fauna matters of NES may be listed in any one of the following categories as defined in *Section 179* of the Act:

- Extinct,
- *Extinct in the wild,
- *Critically endangered,
- *Endangered,
- *Vulnerable,
- Conservation dependent.

*Only these categories are matters of NES under the Act.

The EPBC Act also lists migratory species that are recognized under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals). The EPBC Act is regulated by DAWE.

IUCN Red List

The IUCN Red List is an inventory of the global conservation status of species and used to assist DBCA and other agencies in attributing a given threatened species status. It does not have any statutory authority and is not considered in detail in this assessment.

2 Methods

The survey included a Basic and Targeted survey in line with the EPA's *Technical Guidance Terrestrial vertebrate fauna surveys for environmental impact assessment* (2020).

The following Guidelines were also considered:

- *Commonwealth Matters of National Environmental Significance – Significant impact guidelines 1.1 Environmental Protection and Biodiversity Conservation Act 1999*, Department of the Environment, Water, Heritage and the Arts (DEWHA)', (2009).
- *Commonwealth EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered), Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable), Calyptorhynchus baudinii, and Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso* (SEWPaC 2012).
- *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*. (Commonwealth of Australia 2017)
- *Significant impact guidelines for the vulnerable western ringtail possum (Pseudocheirus occidentalis) in the southern Swan Coastal Plain, Western Australia* Department of the Environment, Water, Heritage and the Arts (DEWHA)', (2009)

2.1 Desktop study

A desktop study was completed, and a potential species list compiled in Appendix C. The study included:

- Database searches for the locality (10 km of the site)
 - Atlas of Living Australia (ALA, 2020)
 - Birddata (BirdLife Australia, 2020)
 - DBCA and WA Museum NatureMap portal (Naturemap 2020) (Appendix D)
 - Index of Biodiversity Surveys for Assessment (IBSA, 2020)
 - Protected Matters Search Tool database (DAWE, 2020) (Appendix D)
- Review of relevant literature on the target species such as recovery plans, journal articles and other publications.
- Review of relevant mapping and spatial datasets, including but not limited to the Government of WA's Shared Land Information Platform (SLIP, 2020) and aerial photography (Landgate, 2020).
- The ecology, habitat and range of target species were evaluated to determine the likelihood of conservation significant fauna occurring within the study area (Appendix D).
- Identification of likely fauna habitat types.

A key aim of the assessment was to determine the likelihood of any species of conservation significance (target species) occurring within the study area and the importance of the study area to them. Common (non-target) species are also considered more generally.

2.1.1 Previous surveys

There were no publicly available existing survey reports available for the property or 10 km study area (IBSA 2020).

2.1.2 Publications

Publications consulted for general distribution of fauna included, but was not limited to:

- A Complete Guide to Reptiles of Australia (Wilson and Swan, 2017)
- A Field Guide to the Mammals of Australia (Menkhorst and Knight, 2013)
- Field guide to frogs of Western Australia (Doughty and Tyler, 2009)
- Frogs of Western Australia (Thomson-Dans and Wardell-Johnson, 2002)
- Handbook Western Australian Birds Vol I (Johnstone and Storr, 1998)
- Michael Morcombe's Birds of Australia eGuide, (Michael Morcombe, 2011)
- Reptiles and Frogs in the Bush: Southwestern Australia (Bush *et al.*, 2007)
- Scats, Tracks and Other Traces: A field guide to Australian mammals (Triggs, 2008)
- The Field Guide to the Birds of Australia (Pizzey and Knight, 2012)
- Waterbirds of South-west Wetlands (Thomson-Dans and Halse, 2001)
- Other online publications, journal articles and other general species references.

2.1.3 Taxonomy and nomenclature

The taxonomy and nomenclature used in this report follows several sources, depending on the faunal group. It primarily follows the Naturemap database (2020) but also the following:

- Amphibians: Bush *et al.* (2007)
- Aves: Pizzey and Knight (2007)
- Mammals: Menkhorst and Knight (2013)
- Reptiles: Wilson and Swan (2017)

2.2 Field surveys

The intent of the field surveys were to validate the desktop assessment, document habitat types and quality, and record any vertebrate fauna observed. Targeted black cockatoo surveys were also conducted. Camera traps were also installed following the initial habitat assessment. Survey effort is shown in Figure 3 (Appendix A).

2.2.1 General habitat assessment and opportunistic recordings

Field work consisted of a diurnal site reconnaissance on 17th and 18th September 2020. Non-systematic opportunistic observations of fauna species were made and recorded, along with secondary evidence of fauna such as tracks, nests, scat, bones, diggings and characteristic feed signs. Fauna habitat quality was based on Table 2-1.

Table 2-1 Fauna habitat quality categories and descriptions (SW Environmental, undated).

Quality	Description
Good	<ul style="list-style-type: none"> Native vegetation with intact and diverse habitat structure. Different vegetation age classes present at most stratum levels (ground, understorey, midstorey, canopy). Forest/woodland: abundant hollow-bearing trees, including those with or likely to develop large hollows. Mature trees offer more foraging resources (nectar/seed). Presence of shelter/refuges at ground level (dense understorey plants, tussock, rocky outcrop, hollow logs). High habitat complexity (ecotones between vegetation types or habitat mosaic). This increases the range of foraging and shelter opportunities within a habitat. Presence of key foraging and microhabitat components for target species. Little to no obvious weed invasion or evidence of grazing. May be large patch and/or connected to other areas of native vegetation.
Moderate	<ul style="list-style-type: none"> Native flora species dominant with moderate habitat structure complexity appropriate to vegetation type. Ground litter intact or slightly disturbed. More than one age class present. Forest/woodland: low to moderate abundance of hollow-bearing trees or trees likely to develop hollows. Some shelter and refuge present for ground dwelling fauna. Some habitat complexity (ecotones between vegetation types or areas forming a habitat mosaic). Marginal presence of key microhabitat components for target species. May be small or large in scale, and isolated or well connected.
Poor	<ul style="list-style-type: none"> Habitat highly disturbed and simplified with low structural complexity. Ground litter layer absent or highly modified. Complexity reduced by only one age class present. Little or no shelter and refuge for ground dwelling fauna. Forest/woodland: not likely to support hollow-bearing trees. Lack of key foraging and microhabitat components for target species. May have evidence of weed invasion or grazing. May be narrow or small area and substantially influenced by edge effects, and isolated from other areas of native vegetation.

2.2.2 Black cockatoos

Black cockatoo habitat surveys included:

- Foraging habitat assessment: The amount and quality of potential black cockatoo foraging habitat was noted, with presence of any feed residue observed (not mapped).
- Roosting habitat survey: Direct and indirect evidence of black cockatoos roosting within trees on site were noted if observed.
- Breeding assessment: Breeding and hollow assessments were based on the black cockatoo breeding requirements described in the section below.

Black cockatoo breeding requirements

Black cockatoos rely on large hollows for breeding, typically >20cm in diameter. Hollows take many years to form. The onset of hollow-formation is dependent on damage to the tree, from fire, animals (vertebrates or invertebrates), or dropping branches. Young and healthy trees can quickly heal after damage and subsequently trees less than 100 years old are unlikely to contain hollows.

For nesting, black cockatoos generally show a preference for

- large senescing trees,
- hollows not angled more than 45 degrees from vertical,
- entrances of at least 12cm but usually much larger (20-30cm),
- deep or well sheltered hollows in main trunk or large branches which are able to provide a floor space of at least 30cm diameter or more.

SW Environmental and Kirkby (2019)

All three species of black cockatoo are a similar size and utilise similar types of tree hollows when breeding. The actual species of tree is probably unimportant to each individual species, for example Carnaby's cockatoo use Wandoo when in the wheatbelt areas and Marri, when in the Marri forest and Karri when in Karri forest areas. All three species are known to use the same individual hollows when not occupied in the breeding season by another black cockatoo species (Kirkby pers comm, 2019).

Jarrah are much less likely than Marri to develop hollows with suitable characteristics required for black cockatoo nesting (Johnstone et al 2013a). It is estimated that upwards of 95% of hollows utilised by black cockatoos in the Jarrah Marri forest are in large Marri rather than Jarrah (Johnstone et al 2013a) (SW Environmental and Kirkby 2019). Wayne (2005) also notes that Marri trees are more likely to develop usable hollows than Jarrah.

Hollows suitable for use by black cockatoos are usually in trees at least 150 years old (Koch 2009). Inions et al. (1989) found that in the Jarrah Forest, large hollows appear to develop in Marri when trees reach a mean age of about 200 years, and in Jarrah when trees reached a mean age of about 300 years, with the average age of trees inhabited being 400 years for Marri and 500 years for Jarrah. Hollows suitable for use by FRTBC are in Marri aged between 140 and 410 years of age (Johnstone et al 2015) and 120 - 150 years in Jarrah (Whitford et al 2013).

Marri, Jarrah and Blackbutt are considered by Commonwealth of Australia (2017) to be large enough to develop hollows once they are >50cm DBH.

Suitable DBH tree survey: Suitable DBH Trees were recorded over the site via approximately 9 km of transects, within and adjacent to the site. These targeted trees with a DBH³ >50cm and considered old enough to start developing large hollows and provide ongoing hollow recruitment (SEWPAC 2012).

- Hollows were recorded with the number, height and size of hollows noted in size classes. Hollow classes included the following hollow entrance sizes

³ DBH – Diameter at breast height

- 20 cm plus - Large hollow, preferred by black cockatoos
- 15-20 cm – Medium hollow, still used by black cockatoos in the absence of large hollows
- 10-15 cm – Small hollow, less likely to be used by black cockatoos
- <10 cm – not used by black cockatoos (too small to access). Not all small hollows were recorded.
- Evidence of use such as chews, wear and other factors were noted along with the suitability of the hollow for black cockatoo breeding, e.g. orientation, access, chamber size or use by other animals.

2.2.3 Camera traps

The initial site visit identified that the study area, in particular the southern dam, may contain potential habitat for Quokka.

Eight camera traps (infrared motion sensing cameras) baited with universal bait and apple, were positioned across the study area, three at the northern site and five in the southern site. The cameras targeted natural clearings, corridors, and other sites likely to be used by native fauna. The cameras were installed for approximately three weeks (16th October and collected 6th November 2020). The survey effort was over a total of 176 trap days. Camera traps were installed under SW Environmental's Section 40 (TFA 2020-0150) of the *Biodiversity Conservation Act 2016*

Remote cameras are recognised as an efficient and useful quantitative technique for monitoring in remote and difficult terrain, with minimal resources and environmental impact. Cameras are likely to be more reliable and accurate than faecal counts or other indirect methods for Quokka (Bain 2015).

2.3 Limitations

In accordance with *Technical Guidance* (EPA 2020) potential survey limitations are identified below.

Table 2-2 Limitations of survey adequacy and accuracy

Aspect	Constraint	Comment
Competency / experience of the survey team, including experience in the bioregion surveyed	No	Suitably qualified individuals carried out the work: Shane Priddle (Ba Marine Science; Certified Environmental Practitioner No.310) with nearly 20 years' experience conducting fauna surveys throughout NSW and WA.
Scope, e.g. where faunal groups were excluded from the survey	No	The scope is adequate to provide the information required to support a clearing assessment. Fish and invertebrates were not sampled for in the field however were considered in the desktop and risk assessment.
Adequacy of the survey intensity and proportion of survey achieved	No	Suitable survey effort has been adopted to identify the fauna constraints associated with the study area. A precautionary approach has also been adopted.

Aspect	Constraint	Comment
The proportion of the task achieved and further work	No	The surveys were completed adequately, to a sufficient level with respect to the scope.
Timing/weather/season	No	The surveys were completed in spring 2020. The survey timing and weather conditions were suitable to detect most target species.
Disturbances that may have affected results of survey	No	There were no disturbances that affected the survey.
Intensity (in retrospect, was the intensity adequate)	No	Based on the results the survey is considered adequate to meet the project scope.
Completeness (e.g. was relevant area fully surveyed);	Negligible	Areas within the southern dam site where inaccessible due to the watercourse and very dense understorey. This may have affected the ability to capture all suitable DBH trees and hollows. Where possible trees were viewed and parked from a distance.
Resources	No	The surveys were completed adequately.
Access problems;	Negligible	Site was on private land and accessible. The centre of the creek line in the southern site was unable to be accessed due to water and dense vegetation. Tree DBH and locations were estimated from a distance for these trees.
Identification of hollows	Low	<p>There are known limitations inherent in the ground survey of hollows - bias with multiple surveyors / survey times due to differing familiarity with tree types, levels of training / expertise, survey conditions such as weather and time of day, and survey technique (Gorrod & Keith 2008, Rayner et al. 2011). Poor visibility (such as overcast weather) is known to affect results also (Rayner et al. 2011).</p> <p>Ground-based counts of hollows are subjective, it is not possible to be certain that the feature is a hollow as seen from the ground. Limitations include the likelihood that some hollows may be missed, may not be observable or may be obscured, particularly hollows in branches and vertical hollows.</p> <p>As well as providing inaccurate counts of hollow abundance, ground-based surveys provide incomplete or inaccurate information on hollow dimensions and use of hollows by fauna (Koch 2008). Generally, ground-based surveys lead to overestimation of hollows (Rayner et al. 2011, Author pers obs.). In forest with dense understorey, such as through drainage lines, it can be difficult to move around the forest floor to maximise visibility into the tree.</p> <p>The suitability of hollow may change over time. There is some risk, though low, that black cockatoos may be breeding in a hollow where evidence of use was not visible or hollow characteristics were atypical.</p> <p>It is also noted that not all active cockatoo hollows show signs of heavy chewing and active or past breeding hollows therefore may be missed.</p>

3 Desktop study

3.1 Local and regional context

3.1.1 Land use

The project is located within vegetated rural land, adjacent to cleared paddocks that have had irrigation lines installed. Both dam footprints include existing smaller dams, with the remnant vegetation over the northern dam covering less area with individual planted non-native trees. The northern dam site has been fenced from the Blackwood State Forest with fine mesh vermin fencing, which may limit access to the patch by some fauna groups. The southern dam site contains relatively intact native vegetation and is contiguous with vegetation from the adjacent Blackwood State Forest. Both sites contain natural drainage features.

3.1.2 Interim Biogeographic Regionalisation of Australia (IBRA) values

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. IBRA also provides for the national and regional planning framework for the systematic development of a comprehensive, adequate and representative (CAR) National Reserve System, endorsed by all levels of government as a key tool for identifying land for conservation under Commonwealth's Australia's Strategy for the National Reserve System 2009-2030 (DE, 2017).

The Project occurs within the north western tip of the Southern Jarrah Forest Sub-region (JAF02) of the Jarrah Forest IBRA region: Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Wandoo - Marri woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands (Hearn et al 2002).

3.1.3 DBCA managed lands

There are numerous DBCA managed reserves (23,100 ha) within 10 km of the study area (SLIP 2020). These account for approximately 68% of local lands (33,950 ha). They include the following:

- Blackwood State Forest
- Blackwood River National Park
- Bramley National Park
- Rapids Conservation Park
- North East Margaret River State Forest
- Other Nature Reserves

The Blackwood State Forest is the closest, occurring within 100 and 200m of the northern and southern dam footprints, respectively.

3.1.4 *Habitat connectivity, linkage, or corridor values*

In a local context there is approximately 25,000 ha of native vegetation mapped (or 74%) remaining within 10 km of the study area (33,950 ha) (Government of Western Australia 2019).

Linkages (SWREL) project identifies regional scale ecological linkages and aims to respond to the issues of fragmentation and climate change through land use planning policy and procedures. It also seeks to retain native vegetation and fauna habitat and reduce the loss of biodiversity and ecological function in the South West. The SWREL axis lines can be summarised as a series of vegetation patches which due to their proximity, act as habitat stepping stones thereby facilitating ecological processes and movement of organisms within and across the landscape (i.e. at the landscape scale) (Molloy et al 2009).

The southern dam falls along the edge of a north south SWREL axis line. Both dams are located within areas mapped as *1a: with and edge touching or < 100m from a linkage* (Molloy et al 2009).

Although the dam footprints are only a small component of the larger network, vegetation within and around the dam sites have a high habitat connectivity, linkage and corridor importance at the patch and landscape scales.

3.1.5 *Important Bird Areas (IBA)*

Important Bird Areas (IBAs) are areas identified by Birdlife International. IBAs are considered conservation priorities, sites able to be conserved in their entirety and are usually part of a protected-area network or recognised as having global bird conservation importance (Birdlife International, 2020). There are no IBAs within 10 km of the study area.

3.2 Environmental values of the study area

3.2.1 *Climate, landform and soils*

The southwest of WA has a Mediterranean climate with mild wet winters and hot dry summers. The following climate summary is based on data from the nearby Margaret River data station (Weatherzone 2020). The temperature ranges from an average maximum of 28°C in the hottest month of February to an average minimum of 8°C in August with an average annual rainfall of 1100 mm, with most of the rain falling between June and August (Weatherzone, 2020).

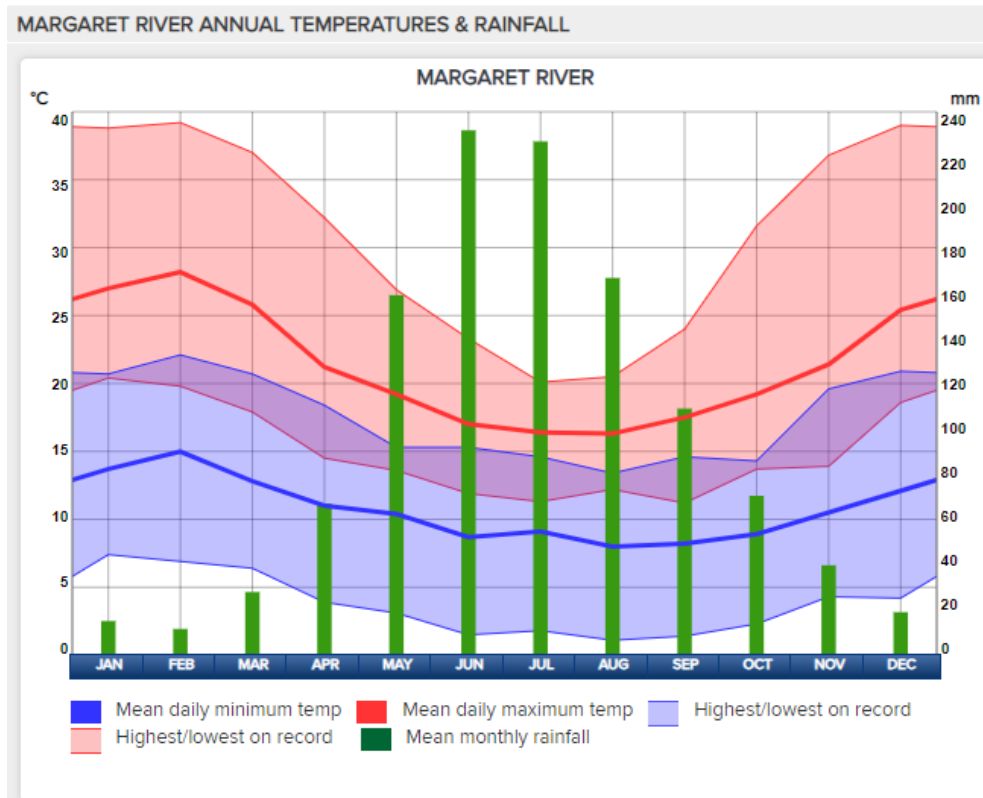


Figure 3 Annual temperatures and rainfall near the study area (Weatherzone 2020)

The dams occur within low points, within an undulating landscape. Soil mapping by the Department of Agriculture and Food (Tille and Lantzke 1990) identifies two main soil units. The northern dam site occurs in the Treeton valley Phase (214ThTRv) - Narrow V shaped drainage depressions, and southern dam site occurs in Treeton wet valley Phase (214ThTRvw) described as broad U-shaped drainage depressions with swampy floors.

3.2.2 Wetlands and watercourses

The term 'wetlands' refers to damplands, estuary-peripheral and water body, floodplains, palusplain and sumplands. The wetland categories are recognised by the EPA, DBCA, DWER and other decision making authorities.

Guidance on protecting the environment during planning and development is set out in the *Environmental Protection Authority's Guidance Statement 33 - Environmental Guidance for Planning and Development* (EPA 2008). Chapter B4 describes the requirements for the protection of wetlands. The EPA considers wetlands in terms of the three broad wetland management categories: Conservation (0-5% disturbed), Resource Enhancement (5-90%) and Multiple Use (90-100% disturbed).

The southern dam site occurs within a Floodplain (ID 110) mapped in the Geomorphic Wetlands (Unreviewed) dataset (Government of Western Australia, 2020). The study area does not contain any wetlands listed under the Consanguineous Wetlands Suites, Directory of Important Wetlands in Australia or RAMSAR (List of Wetlands of International Importance) (Government of Western Australia, 2020).

3.2.3 Vegetation

The site contains native vegetation mapped by Government of WA (2018):

- BD Bidella: Low woodland of *Melaleuca preissiana*-*Banksia littoralis*-*Hakea lasianthoides* on valley floors and open forest to woodland of *Eucalyptus marginata* subsp. *marginata*-*Corymbia calophylla*-*Eucalyptus patens* on slopes in perhumid and humid zones.
- PR Preston: Woodland of *Eucalyptus rudis*-*Agonis flexuosa*-*Banksia seminuda* along streams, open forest of *Corymbia calophylla*-*Eucalyptus patens* on slopes in the humid zone.

The vegetation types contains tree species that may develop large hollows. Hollow bearing trees are critical elements for many fauna species, including many arboreal mammals (such as phascogales and possums), bats and bird species (such as owls and black cockatoos). Animals can be selective in their use of tree hollows, preferentially using hollows of a particular size, shape and orientation. Many hollow dependant fauna are considered threatened, which is often at least partially attributed to a lack of suitable nesting sites (Koch 2008).

Hollows take many years to form. The onset of hollow-formation is dependent on damage to the tree, from fire, animals (vertebrates or invertebrates), or dropping branches. Young and healthy trees can quickly heal after damage and subsequently trees less than 100 years old are unlikely to contain hollows. Suitable DBH trees are discussed in Section 2.2.2.

3.3 Potential fauna records

3.3.1 Fauna recorded locally

Local records, supplemented by species that may occur locally from other literature, are provided in Appendix C. A total of 143 terrestrial species have been recorded locally, with birds by far the most abundant class.

Class	Species
Amphibians	11
Birds	99
Mammals	21
Reptiles	12
TOTAL	143

At least three of the listed fauna are introduced or naturalised species. Invertebrates, marine or aquatic dependant species (fish) are not included. Some near coastal or wetland taxa may be included in the list even though they may not occur within the study area. This list is not exhaustive, nor would all species occur within the study area.

3.3.2 Fauna of conservation significance

Based on the evaluation provided in Appendix D, there are 16 vertebrate fauna of conservation significance that may occur locally (not necessarily within the study area). Additionally, three fish and four invertebrates of conservation significance may also potentially occur locally. A summary is provided below and in Table 3-3.

Class	Species
Amphibians	2
Bird	6
Mammals	8
Reptiles	0
Fish	3
Invertebrate	4
TOTAL	23

Table 3-1 Threatened and Priority fauna recorded, or that may occur, within 10 km of the study area (Naturemap, 2020) (PMST, 2020).

Class	Family	Scientific Name	Vernacular Name	WA Status	EPBC Status
AMPHIBIAN	MYOBATRACHIDAE	<i>Geocrinia alba</i>	White-bellied Frog	CR	EN
	MYOBATRACHIDAE	<i>Geocrinia vitellina</i>	Orange-bellied Frog	VU	VU
AVES	ARDEIDAE	<i>Ixobrychus flavicollis</i>	Black Bittern	P2	
	CACATUIDAE	<i>Calyptorhynchus banksii naso</i>	Forest Red-Tailed Black Cockatoo	VU	VU
	CACATUIDAE	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN
	CACATUIDAE	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN
	FALCONIDAE	<i>Falco peregrinus</i>	Peregrine Falcon	OS	
	TYTONIDAE	<i>Tyto novaehollandiae</i>	Masked Owl	P3	
FISH	GALAXIIDAE	<i>Galaxiella munda</i>	Mud Minnow	VU	
	GEOTRIIDAE	<i>Geotria australis</i>	Pouched Lamprey	P3	
	PERCICHTHYIDAE	<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	VU	VU
INVERT.	CARABIDAE	<i>Trichosternus relictus</i>	a ground beetle Margaret River	P3	
	HYRIIDAE	<i>Westralunio carteri</i>	Carter's Freshwater Mussel	VU	VU
	PARASTACIDAE	<i>Cherax tenuimanus</i>	Margaret River hairy marron	CR	CR

Class	Family	Scientific Name	Vernacular Name	WA Status	EPBC Status
	PARASTACIDAE	<i>Engaewa pseudoreducta</i>	Margaret River Burrowing Crayfish	CR	CR
MAMMALS	DASYURIDAE	<i>Dasyurus geoffroii</i>	Chuditch	VU	VU
	DASYURIDAE	<i>Phascogale tapoatafa</i>	Brush-Tailed Phascogale	CD	
	MACROPODIDAE	<i>Notamacropus irma</i>	Western Brush Wallaby	P4	
	MACROPODIDAE	<i>Setonix brachyurus</i>	Quokka	VU	VU
	MURIDAE	<i>Hydromys chrysogaster</i>	Water-Rat	P4	
	PERAMELIDAE	<i>Isodon fusciventer</i>	Southern Brown Bandicoot	P4	
	PSEUDOCHEIRIDAE	<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR
	VESPERTILIONIDAE	<i>Falsistrellus mackenziei</i>	Western False Pipistrelle	P4	

4 Results

4.1 Fauna habitat

4.1.1 General fauna habitat

Five key fauna habitat types were identified (refer to Table 2.1 for fauna habitat quality definitions)

- Open water (dam) (0.46 ha including existing dams) – Low fauna habitat quality
- Cleared ha (0.15 ha) - Low fauna habitat quality
- Revegetated shrubland (0.27 ha) - Low fauna habitat quality
- Jarrah and Marri open forest (2.16 ha) – High fauna habitat quality

Open forest Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) over open woodland *Banksia grandis*, *Allocasuarina fraseriana* over shrubland *Hovea elliptica*, *Taxandria parviceps* over shrubland/sedgeland *Hibbertia commutata*, *Tetraria capillaris*, *Patersonia umbrosa* over grey sandy clay in the southern site and brown sandy loam in the northern site.

- Bullich and Blackbutt open woodland through the drainage line (2.35 ha) – High fauna habitat quality

Open woodland of Bullich (*Eucalyptus megacarpa*) and Blackbutt (*Eucalyptus patens*) over (closed) shrubland of *Taxandria linearifolia* over mixed sedgeland over grey sandy clay in the southern site and brown sandy loam in the northern site.

Fauna habitat types are mapped in Figure 4 (Appendix A).



Photo 1 Cleared



Photo 2 Revegetated shrubland and Open water



Photo 3 Jarrah and Marri open forest.



Photo 4 Bullich and Blackbutt open woodland through the drainage line.

4.1.2 Suitable DBH trees and hollows

There were a total of 131 suitable DBH trees (i.e. Dead, Jarrah, Marri, or Bullich >50cm DBH) within the study area (Appendix F). This figure includes 55 trees within the northern site and 76 in the southern site. Suitable DBH trees and trees with hollows are mapped in Figure 5 (Appendix A).

Northern site (55):

- Three dead
- 19 Marri
- 33 Jarrah

Southern site (76):

- Four dead
- Five Bullich
- 18 Marri
- 49 Jarrah

Ground surveys identified 20 trees with 26 hollows greater than 10 cm in size. These are mapped in Appendix A. It is unlikely that all of the hollows will actually be hollow – see Limitations in Section 2.3.

4.2 Fauna recorded

Thirty-six species of fauna were observed within the study area. The fauna recorded included 28 birds, five mammals, two of which are pest species (Fox and Rabbit), two frogs and one reptile. Most are common species, with the exceptions of the black cockatoos. Possible indirect evidence of Quokka and Water rat (species of conservation significance) was also observed.

Other faunal groups are likely to occur but are more cryptic, nocturnal or would not have been detected during the diurnal reconnaissance visit (such as bats, possums, reptiles). In addition, a number of species may only use the site as a part of a larger patch, such as other bird species.

Table 4-1 Fauna recorded within the study area

Class	Family	Scientific Name	Vernacular Name	Observed
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia georgiana</i>	Quacking Froglet	Heard
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia glauerti</i>	Glauert's Froglet	Heard
AVES	ACANTHIZIDAE	<i>Acanthiza chrysorrhoa</i>	Yellow-Rumped Thornbill	x
AVES	ACANTHIZIDAE	<i>Acanthiza inornata</i>	Western Thornbill	x
AVES	ACANTHIZIDAE	<i>Sericornis frontalis</i>	White-Browed Scrubwren	x
AVES	ALCEDINIDAE	<i>Dacelo novaeguineae</i>	Kookaburra*	x
AVES	ANATIDAE	<i>Anas superciliosa</i>	Pacific Black Duck	x
AVES	ARTAMIDAE	<i>Artamus cyanopterus</i>	Dusky Woodswallow	x
AVES	ARTAMIDAE	<i>Cracticus tibicen</i>	Australian Magpie	x
AVES	CACATUIDAE	<i>Calyptorhynchus banksii naso</i>	Forest Red-Tailed Black Cockatoo	x
AVES	CACATUIDAE	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Feed residue
AVES	CACATUIDAE	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	x

Class	Family	Scientific Name	Vernacular Name	Observed
AVES	CAMPEPHAGIDAE	<i>Lalage sueurii</i>	White-Winged Triller	x
AVES	COLUMBIDAE	<i>Phaps chalcoptera</i>	Common Bronzewing	x
AVES	COLUMBIDAE	<i>Phaps elegans</i>	Brush Bronzewing	x
AVES	CORVIDAE	<i>Corvus coronoides</i>	Australian Raven	x
AVES	FALCONIDAE	<i>Falco berigora</i>	Brown Falcon	x
AVES	HIRUNDINIDAE	<i>Petrochelidon nigricans</i>	Tree Martin	x
AVES	MALURIDAE	<i>Malurus splendens</i>	Splendid Fairy-Wren	x
AVES	MELIPHAGIDAE	<i>Anthochaera carunculata</i>	Red Wattlebird	x
AVES	MELIPHAGIDAE	<i>Anthochaera lunulata</i>	Western Wattlebird	x
AVES	MELIPHAGIDAE	<i>Melithreptus lunatus</i>	White-Naped Honeyeater	x
AVES	MELIPHAGIDAE	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	x
AVES	MOTACILLIDAE	<i>Anthus australis</i>	Australian Pipit	x
AVES	PACHYCEPHALIDAE	<i>Pachycephala pectoralis</i>	Golden Whistler	x
AVES	PSITTACIDAE	<i>Barnardius zonarius</i>	Australian Ringneck	x
AVES	PSITTACIDAE	<i>Platycercus icterotis</i>	Western Rosella	x
AVES	RHIPIDURIDAE	<i>Rhipidura albiscapa</i>	Grey Fantail	x
AVES	RHIPIDURIDAE	<i>Rhipidura leucophrys</i>	Willie Wagtail	x
AVES	TIMALIIDAE	<i>Zosterops lateralis</i>	Silvereye	x
MAMMALIA	LEPORIDAE	<i>Oryctolagus cuniculus</i>	Rabbit*	x
MAMMALIA	MACROPODIDAE	<i>Setonix brachyurus</i>	Quokka	Possible scat, runnels
MAMMALIA	MACROPODIDAE	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	x
MAMMALIA	MURIDAE	<i>Hydromys chrysogaster</i>	Water-Rat	Possible feed residue
MAMMALIA	CANIDAE	<i>Vulpes vulpes</i>	Fox*	x
REPTILIA	SCINCIDAE	<i>Morethia lineoocellata</i>	West Coast Morethia Skink	x

4.3 Fauna of conservation significance

Database searches and other sources identified 23 fauna of conservation significance, recorded or likely to occur within 10 km of the study area (see Appendix D).

A threatened fauna evaluation table was prepared for conservation significant fauna based on the desktop assessment and site reconnaissance (Appendix B). It excludes marine, marine migratory and regionally extinct species and has been updated with other records where the species may occur. Fauna of conservation significance that possibly occur within the study area are summarised in Table 4-3.

Several conservation significant fauna were recorded within the study area. All three black cockatoos were recorded (Carnaby's and FRTBC observed directly and Baudin's from feed residue).

Table 4-2 Conservation significant fauna that may occur within the study area, based on habitat suitability.

Family Genus species	Vernacular	Status Federal	Stat. WA	Presence of habitat	Likelihood of occurrence
CACATUIDAE <i>Calyptorhynchus banksii</i> <i>naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	Present	Present
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN	Present	Present
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	Present	Present
FALCONIDAE <i>Falco peregrinus</i>	Peregrine Falcon	-	OS	Present	Possible visitor
STRIGIDAE <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i>	Masked Owl (southern subsp)	-	P3	Present	Possible visitor
DASYURIDAE <i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Present	Possible
<i>Phascogale tapoatafa</i>	Southern Brush-tailed Phascogale	-	S	Present	Possible
MACROPODIDAE <i>Notamacropus irma</i>	Western Brush Wallaby		P4	Present	Possible
<i>Setonix brachyurus</i>	Quokka	VU	VU	Present	Possible
MURIDAE <i>Hydromys chrysogaster</i>	Water Rat	-	P4	Present	Possible
PERAMELIDAE <i>Isodon obesulus fusciventer</i>	Southern Brown Bandicoot	-	P4	Present	Possible
VESPERTILIONIDAE <i>Falsistrellus mackenziei</i>	Western False Pipistrelle	-	P4	Present	Possible
GALAXIIDAE <i>Galaxiella munda</i>	Mud minnow, Western dwarf galaxias	-	VU	Present	Possible
PERCICHTHYIDAE <i>Nannatherina balstoni</i>	Balston's Pygmy Perch	VU	VU	Present	Possible
CARABIDAE <i>Trichosternus relictus</i>	a ground beetle Margaret River	-	P3	Present	Possible

5 Species profiles and site values

Peregrine Falcon (*Falco peregrinus*) OS

Peregrine Falcons occur in woodland, plains, gorges, wetlands but tend to breed either in stick-nests in trees or nest on cliff ledges. Hollows and large abandoned nests of other birds may be used where cliff ledges are limited. Breeds Aug-Dec. Where good habitat occurs, and the density of Peregrine Falcons is high, active nests may occur within 2.5km of each other. The diet of the Peregrine Falcon includes wood duck, pigeons and doves, galahs, rosellas and cockatoo, starlings and larks (Olsen et al. 2006).

Peregrine Falcons are wide ranging, with abundant habitat locally. Impacts to this species would be negligible.

Masked Owl (southern subsp) (*Tyto novaehollandiae subsp. novaehollandiae*) P3

Masked Owls inhabit forests, open woodlands and farmlands with large trees, including timber watercourses paperbark woodlands. It nests in large hollows and caves. Widespread but very sparse, they breed any time of the year when conditions are favourable with a nesting period of about three months (Pizzey and Knight 2007).

The species is wide ranging and sparse with no local records (Naturemap 2020). No evidence of nesting was observed within the study area in association with any of the hollows (whitewash or pellets). Given the lack of evidence the species is unlikely to be nesting within the study area and the study area is likely to only have limited foraging value given the amounts of similar habitat locally. Environmental management (fauna spotter) would assist in risk of direct impacts on any individuals during clearing.

Chuditch (*Dasyurus geoffroii*) VU, VU

Chuditch occupy a range of habitats including forest, woodland and desert, though in the SW they are largely restricted to Jarrah forest or scattered through the southern and eastern wheat belt. Current records indicated that this only represents approximately 5% of their former range. Habitat critical to Western Quoll are large areas of undisturbed habitat which a sufficient variety of key food and other resources such as large hollow logs, burrows or small caves at ground level for denning. To be suitable as den sites, logs must have a diameter of at least 30 cm but usually greater than 50 cm, a hollow diameter of 7–20 cm and generally 1m long (Orell & Morris 1994). Annually, an adult female Chuditch will utilise an estimated average of 66 logs and 110 burrows within her home range. A large amount of den sites is required for both sexes. They occupy relatively large home ranges, with males utilizing over 15 km² and females, 3–4 km² (Orell & Morris 1994). There are numerous local records including a 2008 record at the property entrance (Naturemap 2020).

Chuditch were not recorded at the site, however the habitat is likely to be suitable and potentially part of a much larger contiguous patch. If Chuditch did occur within either of the proposed dam footprints, the impact footprint would only represent a small part of habitat for any local individuals. As the project area borders the Blackwood State Forest, there are significant tracts of other relatively secure habitat in close proximity to the site:

- 23,100 ha of DBCA managed reserves within 10 km, accounting for 68% of local lands (SLIP 2020).
- 25,000 ha of native vegetation mapped (or 74%) remaining within 10 km of the study area (Government of Western Australia 2019).

Southern Brush-tailed Phascogale (*Phascogale tapoatafa*) CD (BC Act)

This arboreal species is found in a variety of forest types. Ideal habitat for this species consists of dry sclerophyll forest and open woodland (Jarrah, Marri, and mixed Jarrah Karri) that contain hollow bearing trees and sparse ground cover. Their many nesting sites include hollow tree limbs, rotten stumps and even birds' nests. Lactating females prefer a large tree cavity with a small entrance with a nest made of bark, feathers and fur. A female's home range covers 20 to 70 hectares, a male's home ranges over laps females and increases during breeding season. It is predominantly carnivorous, foraging on arthropods, invertebrates, small vertebrates and nectar (Strahan 1995).

The study area provides suitable habitat but would only be a portion of a larger patch given the species large home range requirements. Given the species large home range clearing of circa 5.11 ha over both sites is unlikely to have any impact on local populations. The loss of an individual is not likely to have a significant impact on local populations of this species. Environmental management (fauna spotter) would assist in risk of direct impacts on any individuals during clearing.

Western Brush Wallaby (*Notamacropus irma*) P4

Optimum habitat for the Western Brush Wallaby includes open Jarrah forest or woodland and seasonally wet flats with low grasses and scrubby thickets, but also areas of mallee and heathland. Common dietary flora includes *Carpobrotus edulis*, *Cynodon dactylon* and *Nuytsia floribunda* (DEC, 2012).

There are three local records within 10km of the project, but none occur within 5km (Naturemap 2020). Habitat at the site may be suitable, in particular the southern dam footprint, but only as a component of a larger patch. Impacts to this species are likely to be low given the relatively small amount of clearing proposed and locally available habitat connected to the sites. This is a mobile animal and would be highly unlikely to be injured during clearing.

Quokka (*Setonix brachyurus*) VU, VU

The ecology of this species in the southern part of its range, where more than 60% of the mainland populations occur, is relatively poorly understood (DEC 2013). The mainland quokka lives in the Darling Range and south-west regions of WA, mostly associated with densely vegetated swamps and sometimes tea-tree thickets along creek systems and dense heath on slopes. Dense, low vegetation provides refuge from predation (Hayward 2002). They tend to shelter in runs among vegetation during the day and forage along the swamp margins at night where they are vulnerable to predators (Hayward et al 2007).

Mainland habitats were thought to be primarily dense riparian vegetation (Hayward et al. 2005; SPRAT 2019). A low density of near-surface fuel, a complex vegetation structure and a varied fire-age mosaic were also thought to best predict the probability of occupancy of quokkas in the southern forest (DEC 2013; Australia Museum 2014; Hayward et al 2007). Previous studies in the northern jarrah forest showed quokkas prefer a habitat with a dense understorey, that hasn't been burnt for more than 10 years, and where predator baiting has occurred.

More recent work by Bain (2015, 2016, 2019) suggests that quokkas prefer habitats with multiple vegetation layers for shelter and protection from predators, a low density of woody debris on the forest floor to enable freedom of movement, and a diverse habitat for feeding and shelter opportunities. Quokka were never found in vegetation with less than three layers (Bain et al 2016).

The presence of canopy for movement appears important (Bain 2016) with a study on the impacts of the 2015 Northcliffe bush fire showing that quokka only ventured 186m from unburnt canopy. They move up to 14 km per night (possibly more) where the areas were connected by dense riparian vegetation (Bain 2019). While riparian vegetation was used exclusively for movement between habitat patches, quokkas spent only 40% of their time in this ecotype and surrounding vegetation types are also important for broader habitat and spatial requirements (Bain 2019).

Young quokka are vulnerable to foxes and feral cats. Foxes and cats are most successful in hunting in open vegetation where there is easy access, such as walk trails or clearings. Contrary to populations in the northern Jarrah forests, quokkas in the Southern Forests still occur in areas with these predators however predation is likely to negatively affect recruitment due to the predators preying on immature animals (Bain 2015, Hayward et al 2007). Fire management, and processes that alter vegetation structure such as feral pigs are other key issues facing quokka (Bain 2015).

Home ranges in the southern forest are about 71 ha (18 ha core area) and individuals move up to 10 km per night, though this varies between sexes and between seasons. Females home ranges were found to overlap but males less so. Low densities of quokka were found in the southern forest sample site 0.08-0.14 / ha (average 0.11/ha), versus the 5-15/ha on Rottnest Island. This is likely due to the lower availability of food resources at ground level (Bain 2015, 2016, 2019). Local populations are more likely to have similarities with southern forest populations than Rottnest populations due to similarities in habitat.

Movement may occur between habitat patches of up to 14 km, but the areas need to be connected by a linear riparian corridor. Emigrations between much large distances are possible with suitable riparian habitat between. In dense vegetation runnels are used by other species such as quenda and

common brushtail possum. Runnels can be used as an indicator of presence but not for determining abundance or timing of last use (Bain 2015, 2016, 2019).

Given the degraded nature of the northern site, limited dense understorey and presence of predators (foxes) they are highly unlikely to occur within that location. The southern dam site however contains potentially suitable habitat for Quokka, i.e. Bullich swamp, dense understorey connected through a drainage line to large areas of state forest upstream. Possible runnels and scat were also observed at the southern dam location. The species was not identified through the use of camera traps however the species may occur in low densities. A higher survey effort may have resulted in a positive identification of the species. Further, the presence of foxes may also be contributing to low numbers, if they are in fact present. The nearest database record is from the Blackwood State Forest about 10km east of the site (Naturemap 2020).

Most of the potential Quokka habitat within the Lot would be cleared. In the context of the site and surrounding habitat and given that the species was not actually detected the loss of 2.05 ha of Blackbutt Bullich drainage line vegetation in the southern dam site (which would represent high quality habitat) is unlikely to have a significant impact on any local Quokka populations. Whilst the clearing would slightly contract existing habitat the southern dam footprint would not fragment any existing populations, given the habitat downstream has been cleared.

Water Rat (*Hydromys chrysogaster*) P4

The Water rat is usually found in permanent fresh or brackish water but can be found in marine environments. Fresh water habitats include swamps, lakes, dams even urban drainage swamps. Typically forages close to the shoreline, restricting its movements to shallow water (up to 2m in depth) (CSIRO, 2004). The nearest records are associated with Margaret River about 6.5 km north of the site. A possible feed middle was found in the northern dam footprint.

The species may occur at the site. Impacts to this species are likely to be low. This is based on the relatively small amount of clearing proposed, that extensive habitat is locally available, and the remaining areas of intact drainage lines will be retained upstream and within the Blackwood State Forest. Environmental management (fauna spotter) would assist in risk of direct impacts on any individuals during clearing.

Southern Brown Bandicoot (*Isodon obesulus fusciventer*) P4

Bandicoot habitat consists of dense scrubby, often swampy vegetation with a dense cover up to one metre high particularly near watercourses/wetlands. It often feeds in adjacent forest (Jarrah and Wandoo) and woodlands that are burnt on a regular basis. Nests can be concealed next to or under old logs, shrubs or piles of debris and are made up of ground litter piled up over a shallow depression providing internal chambers. Home ranges vary with population density and range from 5-8.6 ha for males and 1-6 ha for females (DEC 2010). Feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous fungi. Their searches for food often create distinctive conical holes in the

soil (DECC 2010). There are local records to the west of the site (Naturemap 2020). No evidence observed.

Bandicoot was not detected at the site, and would have been due to the characteristic diggings, had they been present in any numbers. They may occur at the site as part of a larger connected habitat area. Direct impacts of the construction of the two dams on the species are likely to be low. This is based on the relatively small amount of clearing proposed (likely less than one home range at each site), that extensive habitat is locally available, and the remaining areas of intact drainage lines will be retained upstream and within the Blackwood State Forest. Environmental management (fauna spotter) would assist in risk of direct impacts on any individuals during clearing.

Western False Pipistrelle (*Falsistrellus mackenziei*) P4

This microbat occurs in wet sclerophyll forest dominated by Karri, and in the high rainfall zones of the Jarrah and Tuart forests. Since 1961, the species has been collected at 34 locations in south-west Australia. It is known from 27 operational forest 'blocks'. It has also been recorded in mixed Tuart-Jarrah tall woodlands on the adjacent coastal plain. Marri, Sheoak and Peppermint trees are often co-dominant at its collection localities (DEWHA, 2009). This species roosts in tree hollows in colonies of 5 to 30 bats (Aust Museum, 2009) (Phillips & Inwards 1985). The species feed on flying insects between below the forest canopy.

There is a single local records about 7km north of the project (Naturemap 2020). Surveys carried out by Bat Call WA (2009) have recorded the species at sites combining woodland with a nearby (within 1.5 km) permanent fresh water source. Given the presence of Marri/Jarrah with hollows this species cannot be ruled out without further targeted survey work.

If a population of Western False Pipistrelle were present within the study area, it would be impacted directly by loss of habitat (roosting and foraging) as well as potentially the direct mortality of any individuals (potentially a colony) roosting within a hollow tree during clearing. Environmental management (fauna spotter) may assist in risk of direct impacts on any individuals during clearing, but they can be difficult to detect.

Mud minnow, Western dwarf galaxias (*Galaxiella munda*) -, VU

Mud minnows occur in slow-running, tea-coloured streams usually in sandy areas. They have also been found in swamps, small ponds, and roadside ditches. Also lives in the vegetated shallows of some freshwater lakes. Water is typically acidic (pH 4.5-6.5) and darkly tannin-stained. An inhabitant of temporary waters, capable of aestivating in damp bottom sediments over summer (Allen et al 2002) (Smith et al 2002).

Several records occur in the upper Margaret River (DWER 2020) (Naturemap 2020). None are associated with either of the tributaries that the proposed dams are located on, nor were any fish observed during the fieldwork. Survey for aquatic species was outside of the scope of the survey, however, there is some potential for the species to occur in the Mowen River (southern dam site), particularly upstream and

into the Blackwood State Forest. Most of the downstream areas have been highly disturbed and are fragmented from the Margaret River. The proposed dams are both located on the downstream interface of the vegetated and intact section of forest, with the cleared and grazed areas downstream. If they did occur at either site, the loss would be between 300-450m of stream habitat though they may potentially persist in the shallow edges of the dam once constructed.

Balston's Pygmy Perch (*Nannatherina balstoni*) VU, VU

Balston's Pygmy Perch is a small freshwater fish that grows to a maximum length of around 90 mm (commonly 60 mm). This species is brownish dorsally and silver below, usually with a prominent brown mid-lateral stripe and a series of vertical brown bars on sides giving a cross-hatched pattern. Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west WA, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (SPRAT 2018)(Bray et al. 2018). Associated with slow-flowing, low salinity, acidic and tannin-stained waters, and complex instream habitat – recorded locally (DWER 2020).

Local records are associated with Margaret River. None are associated with either of the tributaries that the proposed dams are located on, nor were any fish observed during the fieldwork. Survey for aquatic species was outside of the scope of the survey, however, there is some potential for the species to occur in the Mowen River (southern dam site), particularly upstream and into the Blackwood State Forest. Most of the downstream areas have been highly disturbed and are fragmented from the Margaret River. The proposed dams are both located on the downstream interface of the vegetated and intact section of forest, with the cleared and grazed areas downstream. Similar to Mud minnow, if they did occur at either site, the loss would be between 300-450m of stream habitat though they may potentially persist in the shallow edges of the dam once constructed.

Ground beetle Margaret River (*Trichosternus relictus*) P3

Has been found under logs in Eucalyptus woods (Bennelongia Pty Ltd, 2013).

As the project area borders the Blackwood State Forest, there are significant tracts of other relatively secure habitat in close proximity to the site:

- 23,100 ha of DBCA managed reserves within 10 km, accounting for 68% of local lands (SLIP 2020).
- 25,000 ha of native vegetation mapped (or 74%) remaining within 10 km of the study area (Government of Western Australia 2019).

As little is known of this species and that invertebrate surveys were out side of the scope of the project, this beetle has not been considered further.

5.1.2 Black cockatoos

Baudin's Cockatoo (*Calyptorhynchus baudinii*) EN, EN

Baudin's Cockatoo is a large, iconic forest cockatoo endemic to the south west corner of WA. It has suffered a substantial decline in number in the past 50 years. Direct causes of this decline include large numbers shot by orchardists, fragmentation of habitat and the impact of hollow competitors (Johnstone and Kirkby 2008). Depending on their region of origin, Baudin's cockatoo is a resident, a post nuptial nomad or migrant with the bulk of the population vacating the coldest parts of their range (i.e. the Karri forest block) in the autumn and migrating northwards during the non-breeding season. Small numbers also appear resident in a few places including Leeuwin – Naturaliste Ridge and Manjimup (Johnstone and Kirkby 2008). Flock sizes vary from small family groups to large aggregations at roosting sites.

In the non-breeding season, Baudin's Cockatoo is mainly an inhabitant of the Jarrah Marri forest but is also frequently seen in farmland and orchards. It feeds on a variety of foods including nectar and seeds from hakeas and banksia spp. also apples, persimmons and macadamias. Overall, its main food is Marri from which it takes seeds, grubs and nectar. Its long bill is adapted to removing seeds from Marri fruit capsules.

Roost sites are usually in smooth barked eucalypts (occasionally rough barked eucalypts, i.e. Marri, Jarrah and Blackbutt) including Wandoo, Flooded Gum, Bullich and smooth barked exotic eucalypts including plantations (Johnstone and Kirkby 2008).

Feed residue was observed within the study area throughout both sites.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) EN, EN

This species is a postnuptial nomad, tending to move west after breeding. Carnaby's cockatoo mainly occurs in or near eucalypt woodlands, especially those dominated by Wandoo or Salmon Gum, and sometimes reported in forests of Marri, Jarrah, Karri and Tuart. Nesting hollows may be located anywhere over two metres from ground, mainly in the Wheatbelt (Cale 2003, SPRAT 2019, WA Museum 2010).

It is known to forage in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. Hakea spp. and Grevillea spp. Forages in pine plantations, eucalypt woodland and forest that contains foraging species, individual trees and small stands of these species (SEWPAC 2012).

This species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain. This may be due to climate change. Breeding occurs mainly from early July to mid-December. Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick, for example adjacent pine forest or remnant vegetation (Johnstone and Kirkby, Undated). Carnaby's Cockatoo is also known to breed in Karri forest at Porongurup, Walpole, Albany, Denmark and Mount Manypeaks.

Carnaby's Cockatoos are known to roost in Jarrah, Marri, Blackbutt, Bullich, exotic eucalypt species and pines.

The species was seen, and feed residue observed across the study area.

Forest Red-tailed Black Cockatoo (*Calyptrorhynchus banksii naso*) (FRTBC) VU, VU

The FRTBC is a large, iconic forest cockatoo, endemic to the south-west corner of Western Australia. Formerly common, but now rare to uncommon and patchily distributed, it has disappeared from about 30% of its former range. It has suffered a marked decline in numbers over the past 60 years. The main reasons for this decline include the destruction and fragmentation of habitat (especially Jarrah-Marri forest), the apparent decline in Marri along the eastern side of the Darling Scarp, logging, the impact of hollow competitors, fire and possibly climate change (Johnstone, Kirkby and Sarti 2013a, b). FRTBC occurs throughout the Jarrah Marri Karri forested areas but in recent years has been foraging out on to the Swan Coastal Plain feeding on the seeds of Cape Lilac. Group sizes vary from small family groups and pairs to larger gatherings at roost sites.

FRTBC nest in hollows Jarrah, Marri, Blackbutt, Bullich and Wandoo. Hollows have been recorded from 6.5 – 33 m above ground (Johnstone Kirkby and Sarti 2015). FRTBC have been recorded breeding in all months but with peaks in Spring and Autumn. There are also years when very little if any breeding takes place i.e. 2008 and 2009 (Johnstone and Kirkby unpublished data). The nearest known breeding location to the project area is 36 km to the north west at Nannup.

FRTBC feed mainly on the seeds of Jarrah and Marri but also Blackbutt, Albany Blackbutt, Sheoak, Snottygobble and introduced native and non-native species such as Lemon-scented Gum, Spotted Gum and Cape Lilac (SPRAT 2019).

FRTBC are known to roost in Jarrah, Marri, Blackbutt, Bullich and introduced eucalypt species.

The species was seen, and feed residue was observed across the study area.

Breeding habitat

Black cockatoo breeding requirements are outlined in Section 2.2.2. Hollows and suitable DBH trees are discussed in Section 4.1.2 and mapped in Figure 6 (Appendix A). Hollow suitability and likelihood of being used for breeding by black cockatoos are shown in Table 5-1.

Eight tree (three trees within the northern site, and five within the southern site), had some potential to be used by black cockatoos for breeding based on typical black cockatoo breeding hollow attributes such as orientation, access, chamber size or use by other animals. None showed any characteristics that would indicate recent or older use (chews). The possible exception was tree ID149 that had some possible chews around the rim of a potential hollow but there is a high chance that the flaking of bark could be natural as the hollow does not appear to be well developed. Refer to Photo 5, below.

There were a total of 131 suitable DBH trees (i.e. Dead, Jarrah, Marri, or Bullich >50cm DBH) within the study area that may develop hollows in the medium to longer term.



Photo 5 Potential hollow with possible chews.

Table 5-1 Summary of hollow attributes across the study area

ID	Tree species	Hollows	Black cockatoo breeding likelihood	Site
10	Jarraah	1	Not likely	Northern
15	Jarraah	1	Not likely	Northern
18	Marri	1	Not likely	Northern
30	Dead	1	Not likely	Northern
41	Dead	2	Not likely	Northern
42	Jarraah	2	Potential	Northern
45	Jarraah	1	Potential	Northern
46	Jarraah	2	Potential	Northern
50	Jarraah	1	Not likely	Northern
54	Jarraah	1	Not likely	Northern
103	Dead	1	Potential	Southern
127	Dead	1	Not likely	Southern
137	Dead	2	Not likely	Southern
81	Jarraah	2	Potential	Southern
89	Jarraah	1	Not likely	Southern
101	Jarraah	1	Potential	Southern
145	Jarraah	1	Potential	Southern
153	Jarraah	2	Not likely	Southern
96	Marri	1	Not likely	Southern
149	Marri	1	Potential	Southern

Foraging habitat and roost sites

Feed residue (chewed Marri cones) were observed broadly over both sites for all three black cockatoo species. Marri and Jarrah are plant species known to be utilised by all three black cockatoos for foraging and available broadly over both sites. Blackbutt may also be a suitable foraging plant for Baudins and FRTBC, though these occur in lower densities through the drainage lines.

- Jarrah and Marri open forest (2.16 ha) – High quality foraging habitat
- Bullich and Blackbutt open woodland through the drainage line (2.35 ha) – Lower quality foraging habitat

There was no evidence of roosts observed at the either dam site.



Photo 6 Black cockatoo feed residue (probable Baudins bottom left - no chews on the rim, Carnaby's top and FRTBC bottom right)

6 Conclusions and Recommendations

The site contained five habitat types with most of the site providing high fauna habitat quality. Other important habitat features are large hollow fallen timber, or water features including the natural seasonal drainage lines and artificial dam sites, and intact riparian vegetation.

One hundred and forty two terrestrial vertebrate fauna species have been recorded locally with five birds, seven mammals, two fish and one invertebrate of conservation significance that may occur at the site based on habitat attributes. At least three of the locally occurring species are introduced species.

Thirty-five species of fauna were observed within the study area which is likely to be only a subset of the species that would utilise the site. The fauna recorded included 28 birds, four mammals, two frogs and one reptile. Most are common species, with the exceptions of the black cockatoos, Quokka (possible) and Water rat (possible) which are species of conservation significance.

Of the conservation significant fauna that may occur, black cockatoos (largely due to the impact definition outlined in the guidelines), and Quokka (if they occur) are most likely to be impacted by the project. Others may also occur but are less likely to be impacted or are likely to have larger home ranges overlapping extensive areas of native vegetation that occurs upstream and into the State Forest.

The following recommendations are made:

- Clearing should be conducted outside of spring to minimise impacts to breeding fauna.
- A licensed fauna spotter should be on site during the clearing, particularly during the clearing of hollow trees.
- Large hollows should be rechecked prior (within a week) to clearing to confirm that no black cockatoos are breeding.
- Large or hollow trees that occur on the dam edge should be retained where possible.
- The final impact footprints should be checked against the significant impact criteria (DEWHA 2013; SEWPAC 2012) for black cockatoos and other matters of NES to determine the need to refer the project to DAWE. It is noted that it is the proponent's responsibility to refer the action for legal certainty.

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Appendix A Figures

Figure 1 Locality

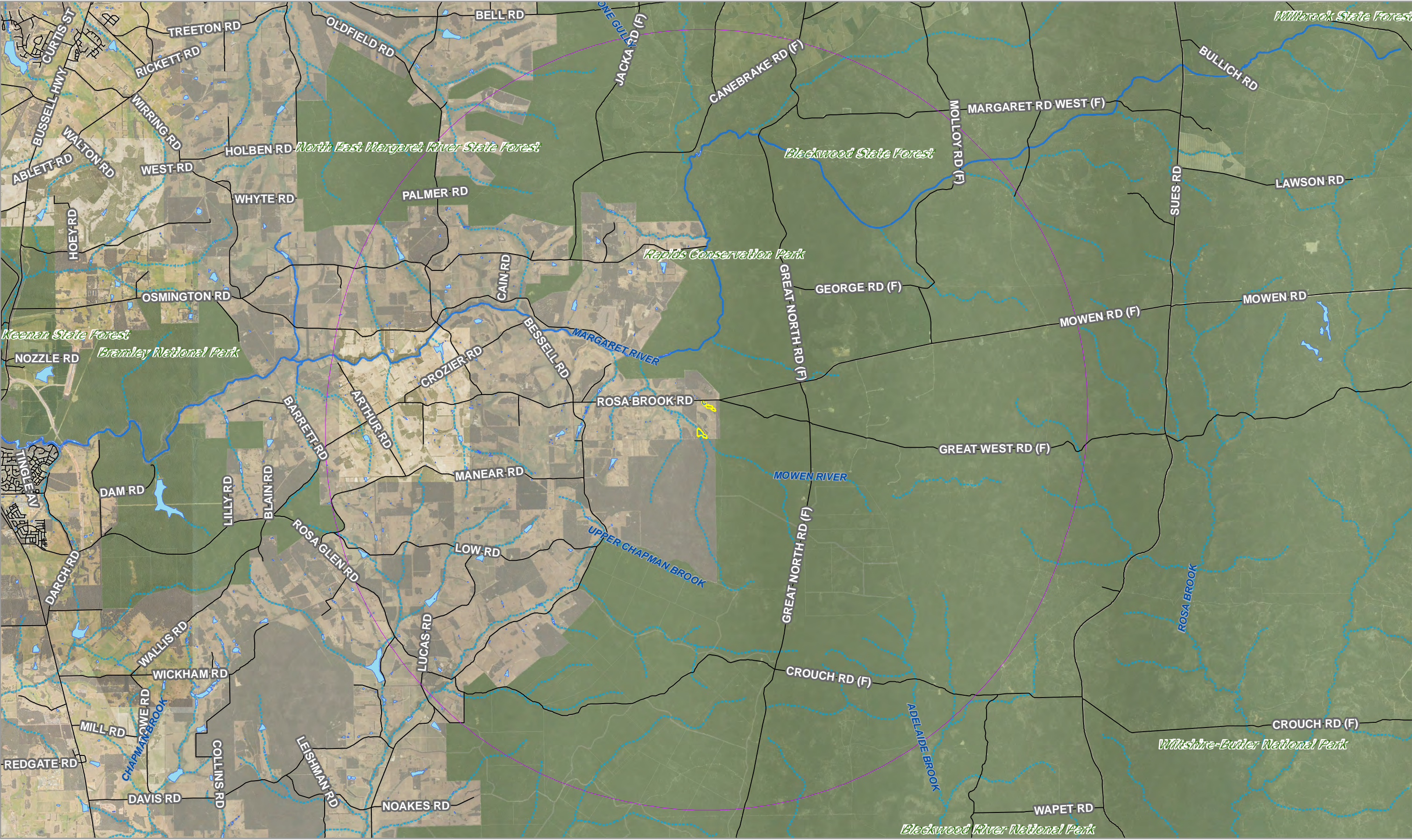
Figure 2 Study area

Figure 3 Fauna survey effort

Figure 4 Fauna habitat types

Figure 5 Suitable DBH trees and trees with hollows

Figure 6 Black cockatoo breeding likelihood



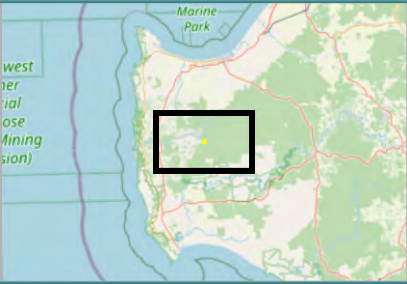
BASIC AND TARGETED FAUNA SURVEY

LOT 2919 ROSA BROOK RD, ROSA BROOK

FIGURE 1 LOCALITY

Ref: SW263 Rosa Brook F1
Date: 22/10/2020 Author: SP

- Locality (10 km)
- Existing dam
- Study areas
- Major watercourse
- Minor drainage line
- DBCA managed land



A3 @ 1:95000

0 0.5 1 2 km

GRID: GDA zone 50



Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)



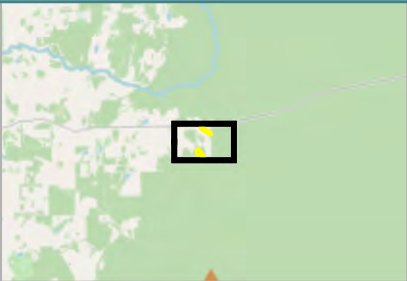
BASIC AND TARGETED FAUNA SURVEY

LOT 2919 ROSA BROOK RD, ROSA BROOK

FIGURE 2 STUDY AREA

Ref: SW263 Rosa Brook F2
Date: 22/10/2020 Author: SP

- Existing dam
- Study areas
- Minor drainage line
- DBCA managed land



A3 @ 1:5000

0 25 50 100 m

GRID: GDA zone 50



Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)



BASIC AND TARGETED FAUNA SURVEY

LOT 2919 ROSA BROOK RD, ROSA BROOK

FIGURE 6 BLACK COCKATOO BREEDING LIKELIHOOD

Ref: SW263 Rosa Brook F3
Date: 22/10/2020 Author: SP

- ▲ Camera trap location
- DBCA managed land
- - - Transect (foot traverse)
- Existing dam
- Study areas
- - - Minor drainage line

Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)



A3 @ 1:5000

0 25 50 100 m

GRID: GDA zone 50

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BASIC AND TARGETED FAUNA SURVEY

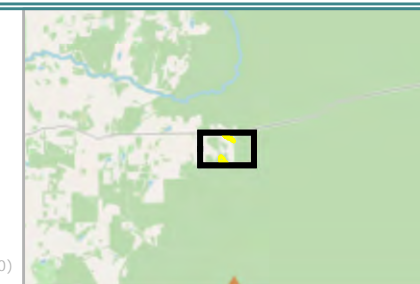
LOT 2919 ROSA BROOK RD, ROSA BROOK

FIGURE 4 FAUNA HABITAT TYPES

Ref: SW263 Rosa Brook F4
Date: 13/11/2020 Author: SP

- Study areas
- Fauna habitat**
- Cleared
- Jarrah and Marri open forest
- Bullich and Blackbutt open woodland through the drainage line
- Revegetated shrubland
- Open water (dam)
- Minor drainage line
- DBCA managed land

Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)

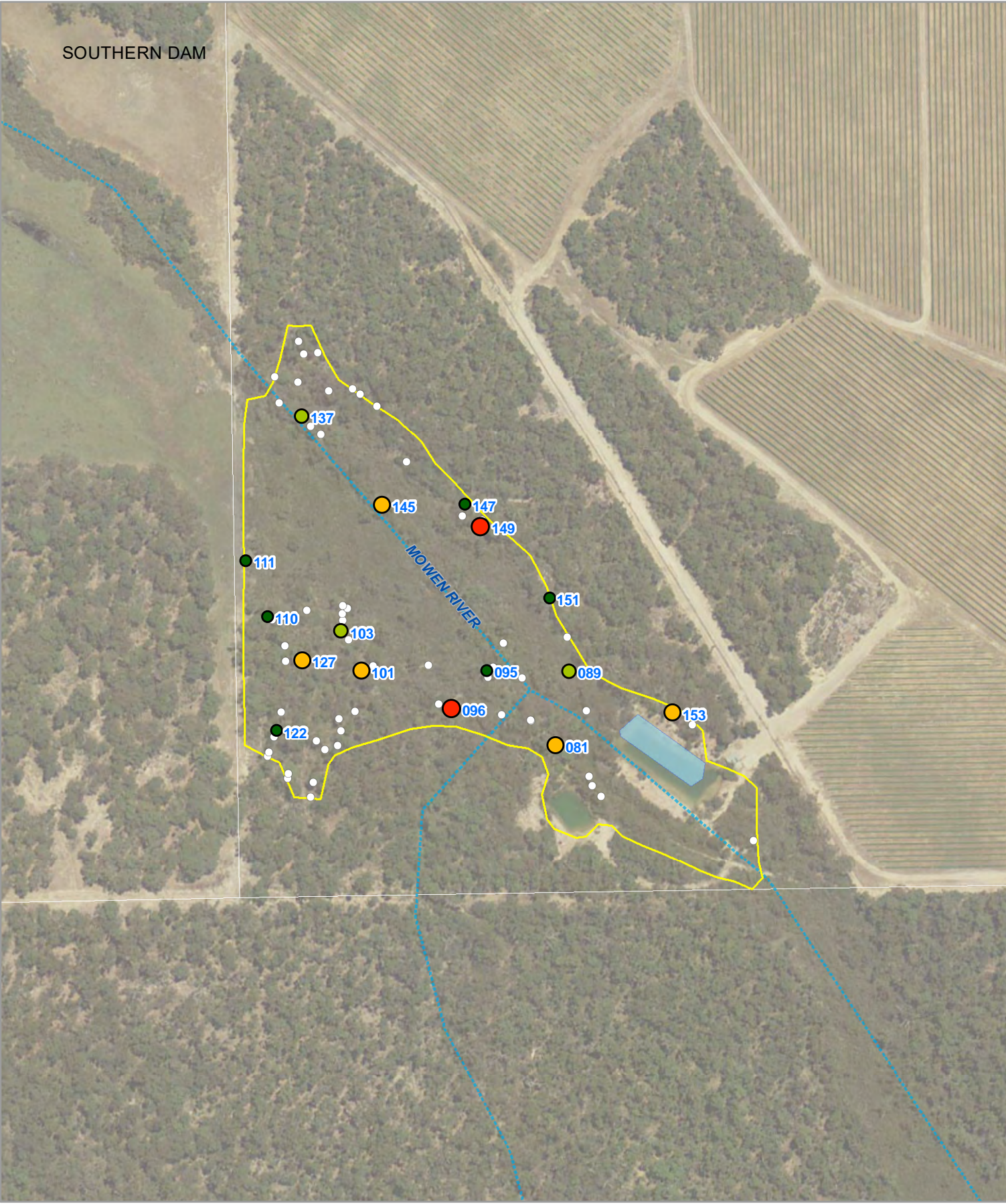


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BASIC AND TARGETED FAUNA SURVEY

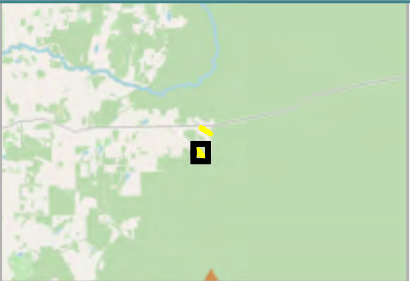
LOT 2919 ROSA BROOK RD, ROSA BROOK

FIGURE 5 SUITABLE DBH TREES AND TREES WITH HOLLOWS

Ref: SW263 Rosa Brook F5
Date: 6/11/2020 Author: SP

- Hollow size
 - 20cm plus
 - 15 to 20cm
 - 10 to 15cm
 - <10cm
- Suitable DBH tree ○
- Existing dam ■
- Study areas □
- Minor drainage line - - -

Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)



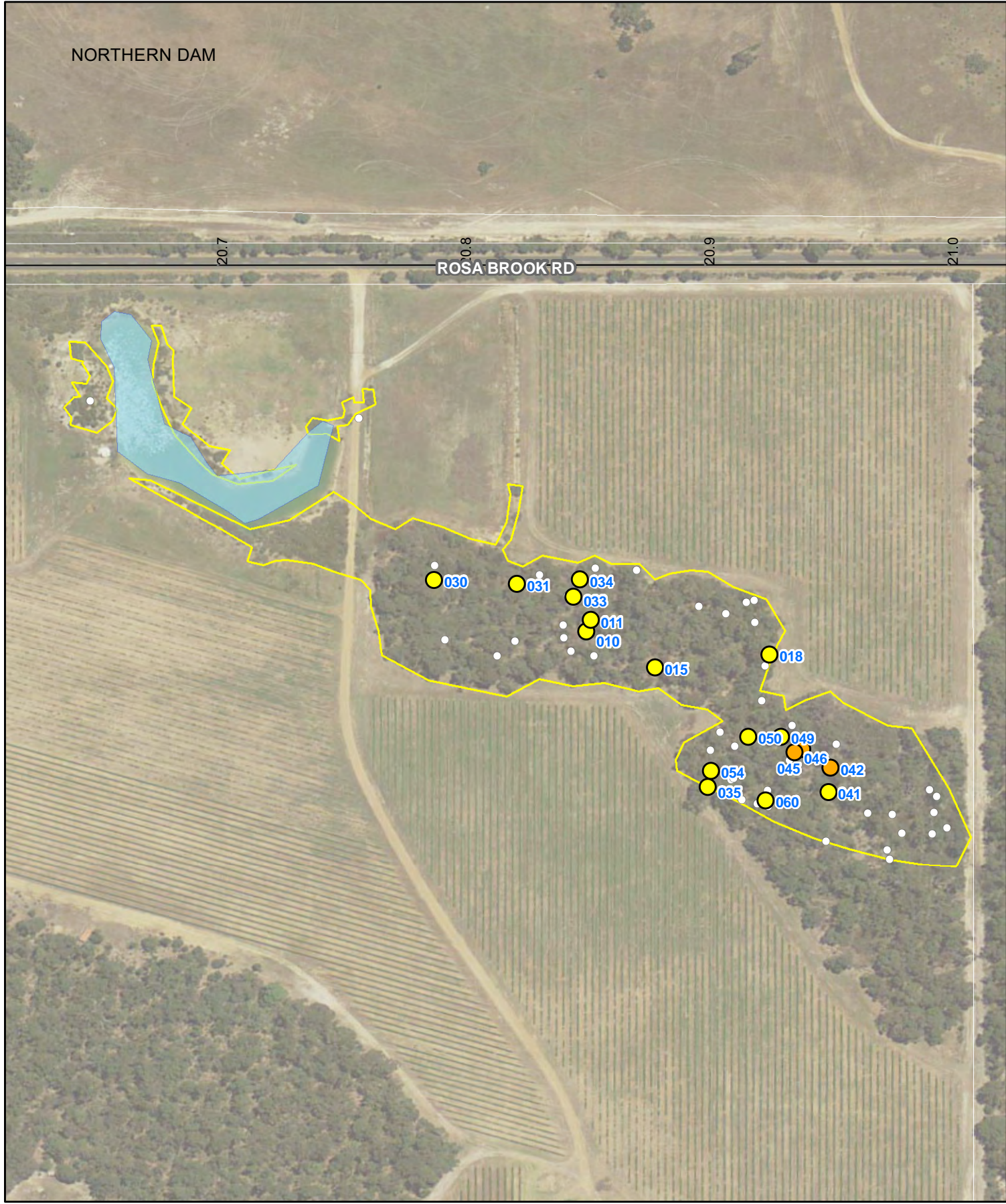
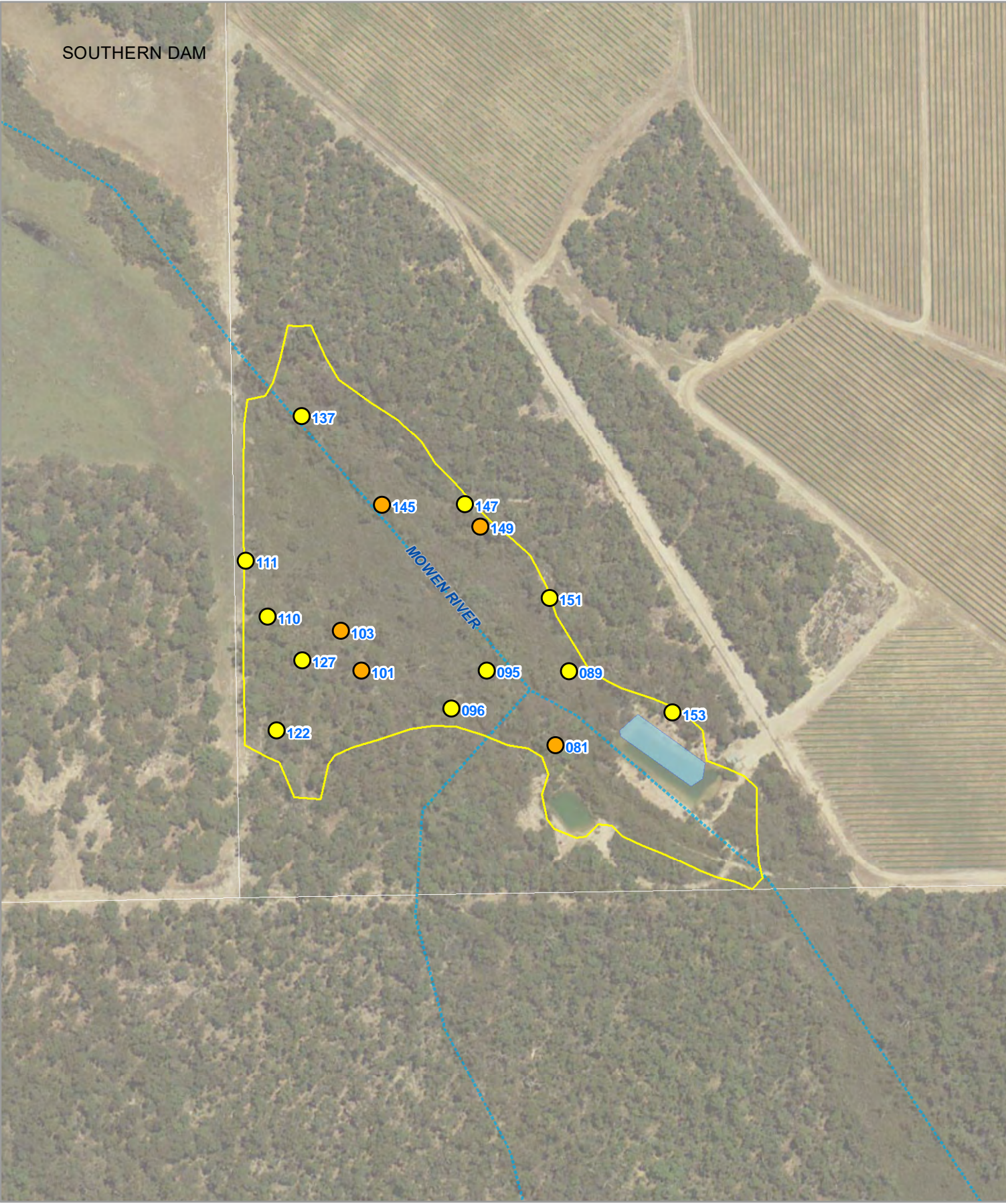
A3 @ 1:2500

0 20 40 80 m

GRID: GDA zone 50

SW
environmental

www.swenvironmental.com.au



BASIC AND TARGETED FAUNA SURVEY

LOT 2919 ROSA BROOK RD, ROSA BROOK

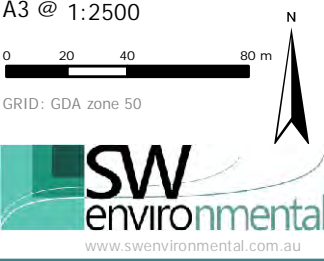
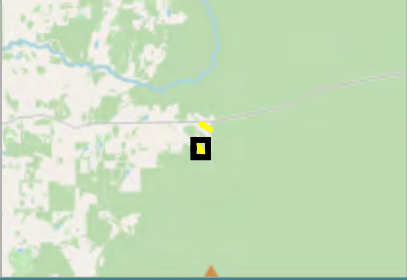
FIGURE 6 BLACK COCKATOO BREEDING LIKELIHOOD

Ref: SW263 Rosa Brook F6
Date: 19/11/2020 Author: SP

- Active black cockatoo nest - none observed
- Potential to be suitable for use by black cockatoos for breeding
- Not likely to be used by black cockatoos for breeding
- Existing dam
- Study areas

--- Minor drainage line

Source: Base map © Esri and its data suppliers. SLIP Landgate (2020)



Appendix B Conservation codes

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

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

VU **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

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

EX Extinct species

Species where “*there is no reasonable doubt that the last member of the species has died*”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that “*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

MI 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; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

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

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, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P **Priority species**

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

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

2 Priority 2: Poorly-known species

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

3 Priority 3: Poorly-known species

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

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

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

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

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

¹ The definition of flora includes algae, fungi and lichens

² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix C Potential fauna list and fauna recorded

Class	Family	Scientific Name	Vernacular Name	Observed	Local records	Status	WA Status	EPBC Status
AMPHIBIA	HYLIDAE	<i>Litoria adelaidensis</i>	Slender Tree Frog		x			
AMPHIBIA	HYLIDAE	<i>Litoria moorei</i>	Moore's Frog		x			
AMPHIBIA	LIMNODYNASTIDAE	<i>Heleioporus eyrei</i>	Moaning Frog		x			
AMPHIBIA	LIMNODYNASTIDAE	<i>Limnodynastes dorsalis</i>	Sand Frog		x			
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia georgiana</i>	Quacking Froglet	x	x			
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia glauerti</i>	Glauert's Froglet	x	x			
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia pseudinsignifera</i>	False Western Froglet		x			
AMPHIBIA	MYOBATRACHIDAE	<i>Geocrinia alba</i>	White-bellied Frog		Local records	T	CR	EN
AMPHIBIA	MYOBATRACHIDAE	<i>Geocrinia leai</i>	Ticking Frog		x			
AMPHIBIA	MYOBATRACHIDAE	<i>Geocrinia vitellina</i>	Orange-bellied Frog		Local records	T	VU	VU
AMPHIBIA	MYOBATRACHIDAE	<i>Metacrinia nichollsi</i>	Nicholl's Toadlet		x			
AVES	ACANTHIZIDAE	<i>Acanthiza apicalis</i>	Inland Thornbill		x			
AVES	ACANTHIZIDAE	<i>Acanthiza chrysorrhoa</i>	Yellow-Rumped Thornbill	x	x			
AVES	ACANTHIZIDAE	<i>Acanthiza inornata</i>	Western Thornbill	x	x			
AVES	ACANTHIZIDAE	<i>Gerygone fusca</i>	Western Gerygone		x			
AVES	ACANTHIZIDAE	<i>Sericornis frontalis</i>	White-Browed Scrubwren	x	x			
AVES	ACANTHIZIDAE	<i>Smicrornis brevirostris</i>	Weebill		x			
AVES	ACCIPITRIDAE	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk		x			
AVES	ACCIPITRIDAE	<i>Accipiter fasciatus</i>	Brown Goshawk		x			
AVES	ACCIPITRIDAE	<i>Aquila audax</i>	Wedge-Tailed Eagle		x			
AVES	ACCIPITRIDAE	<i>Haliastur sphenurus</i>	Whistling Kite		x			
AVES	ACCIPITRIDAE	<i>Hamirostra isura</i>	Square-Tailed Kite		x			
AVES	ACCIPITRIDAE	<i>Pandion haliaetus</i>	Osprey		x			
AVES	AEGOTHELIDAE	<i>Aegotheles cristatus</i>	Australian Owlet-Nightjar		x			
AVES	ALCEDINIDAE	<i>Dacelo novaeguineae</i>	Kookaburra*	x	x			
AVES	ALCEDINIDAE	<i>Todiramphus sanctus</i>	Sacred Kingfisher		x			
AVES	ANATIDAE	<i>Anas platyrhynchos</i>	Mallard Duck		x			
AVES	ANATIDAE	<i>Anas superciliosa</i>	Pacific Black Duck	x	x			
AVES	ANATIDAE	<i>Biziura lobata</i>	Musk Duck		x			

Class	Family	Scientific Name	Vernacular Name	Observed	Local records	Status	WA Status	EPBC Status
AVES	ANATIDAE	<i>Chenonetta jubata</i>	Australian Wood Duck		x			
AVES	ANATIDAE	<i>Tadorna tadornoides</i>	Australian Shelduck		x			
AVES	ANHINGIDAE	<i>Anhinga novaehollandiae</i>	Australasian Darter		x			
AVES	ARDEIDAE	<i>Ardea novaehollandiae</i>	White-Faced Heron		x			
AVES	ARDEIDAE	<i>Ixobrychus flavicollis</i>	Black Bittern		x	P2		
AVES	ARTAMIDAE	<i>Artamus cinereus</i>	Black-Faced Woodswallow		x			
AVES	ARTAMIDAE	<i>Artamus cyanopterus</i>	Dusky Woodswallow	x	x			
AVES	ARTAMIDAE	<i>Cracticus tibicen</i>	Australian Magpie	x	x			
AVES	ARTAMIDAE	<i>Cracticus torquatus</i>	Grey Butcherbird		x			
AVES	ARTAMIDAE	<i>Strepera versicolor</i>	Grey Currawong		x			
AVES	CACATUIDAE	<i>Cacatua roseicapilla</i>	Galah		x			
AVES	CACATUIDAE	<i>Calyptorhynchus banksii naso</i>	Forest Red-Tailed Black Cockatoo	x	x	T	VU	VU
AVES	CACATUIDAE	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	x	x	T	EN	EN
AVES	CACATUIDAE	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	x	x	T	EN	EN
AVES	CAMPEPHAGIDAE	<i>Coracina novaehollandiae</i>	Black-Faced Cuckoo-Shrike		x			
AVES	CAMPEPHAGIDAE	<i>Lalage sueurii</i>	White-Winged Triller	x	x			
AVES	CASUARIIDAE	<i>Dromaius novaehollandiae</i>	Emu		x			
AVES	CHARADRIIDAE	<i>Vanellus (Lobivanellus) tricolor</i>	Banded Lapwing		x			
AVES	CLIMACTERIDAE	<i>Climacteris rufus</i>	Rufous Treecreeper		x			
AVES	COLUMBIDAE	<i>Phaps chalcoptera</i>	Common Bronzewing	x	x			
AVES	COLUMBIDAE	<i>Phaps elegans</i>	Brush Bronzewing	x	x			
AVES	CORVIDAE	<i>Corvus coronoides</i>	Australian Raven	x	x			
AVES	CUCULIDAE	<i>Cacomantis flabelliformis</i>	Fan-Tailed Cuckoo		x			
AVES	CUCULIDAE	<i>Cacomantis pallidus</i>	Pallid Cuckoo		x			
AVES	CUCULIDAE	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo		x			
AVES	ESTRILDIDAE	<i>Stagonopleura oculata</i>	Red-Eared Firetail		x			

Class	Family	Scientific Name	Vernacular Name	Observed	Local records	Status	WA Status	EPBC Status
AVES	FALCONIDAE	<i>Falco berigora</i>	Brown Falcon	x	x			
AVES	FALCONIDAE	<i>Falco peregrinus</i>	Peregrine Falcon		Possible	OS		
AVES	HIRUNDINIDAE	<i>Hirundo neoxena</i>	Welcome Swallow		x			
AVES	HIRUNDINIDAE	<i>Petrochelidon nigricans</i>	Tree Martin	x	x			
AVES	MALURIDAE	<i>Malurus elegans</i>	Red-Winged Fairy-Wren		x			
AVES	MALURIDAE	<i>Malurus splendens</i>	Splendid Fairy-Wren	x	x			
AVES	MALURIDAE	<i>Stipiturus malachurus</i>	Southern Emu-Wren		x			
AVES	MEGALURIDAE	<i>Cincloramphus mathewsi</i>	Rufous Songlark		x			
AVES	MEGAPODIIDAE	<i>Leipoa ocellata</i>	Malleefowl		x	T		
AVES	MELIPHAGIDAE	<i>Acanthorhynchus superciliosus</i>	Western Spinebill		x			
AVES	MELIPHAGIDAE	<i>Anthochaera carunculata</i>	Red Wattlebird	x	x			
AVES	MELIPHAGIDAE	<i>Anthochaera lunulata</i>	Western Wattlebird	x	x			
AVES	MELIPHAGIDAE	<i>Gliciphila melanops</i>	Tawny-Crowned Honeyeater		x			
AVES	MELIPHAGIDAE	<i>Lichmera indistincta</i>	Brown Honeyeater		x			
AVES	MELIPHAGIDAE	<i>Melithreptus brevirostris</i>	Brown-Headed Honeyeater		x			
AVES	MELIPHAGIDAE	<i>Melithreptus lunatus</i>	White-Naped Honeyeater	x	x			
AVES	MELIPHAGIDAE	<i>Phylidonyris niger</i>	White-Cheeked Honeyeater		x			
AVES	MELIPHAGIDAE	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	x	x			
AVES	MEROPIDAE	<i>Merops ornatus</i>	Rainbow Bee-Eater		x			
AVES	MONARCHIDAE	<i>Grallina cyanoleuca</i>	Magpie-Lark		x			
AVES	MOTACILLIDAE	<i>Anthus australis</i>	Australian Pipit	x	x			
AVES	NEOSITTIDAE	<i>Daphoenositta (Neositta) chrysoptera</i>	Varied Sittella		x			
AVES	PACHYCEPHALIDAE	<i>Colluricincla harmonica</i>	Grey Shrike-Thrush		x			
AVES	PACHYCEPHALIDAE	<i>Falcunculus frontatus</i>	Crested Shrike-Tit		x			
AVES	PACHYCEPHALIDAE	<i>Pachycephala occidentalis</i>	Western Whistler		x			
AVES	PACHYCEPHALIDAE	<i>Pachycephala pectoralis</i>	Golden Whistler	x	x			
AVES	PACHYCEPHALIDAE	<i>Pachycephala rufiventris</i>	Rufous Whistler		x			
AVES	PARDALOTIDAE	<i>Pardalotus punctatus</i>	Spotted Pardalote		x			
AVES	PARDALOTIDAE	<i>Pardalotus striatus</i>	Striated Pardalote		x			

Class	Family	Scientific Name	Vernacular Name	Observed	Local records	Status	WA Status	EPBC Status
AVES	PETROICIDAE	<i>Eopsaltria georgiana</i>	White-Breasted Robin		x			
AVES	PETROICIDAE	<i>Eopsaltria griseogularis</i>	Western Yellow Robin		x			
AVES	PETROICIDAE	<i>Petroica boodang</i>	Scarlet Robin		x			
AVES	PETROICIDAE	<i>Petroica goodenovii</i>	Red-Capped Robin		x			
AVES	PHALACROCORACIDAE	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant		x			
AVES	PHALACROCORACIDAE	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant		x			
AVES	PHALACROCORACIDAE	<i>Phalacrocorax varius</i>	Pied Cormorant		x			
AVES	PHASIANIDAE	<i>Coturnix pectoralis</i>	Stubble Quail		x			
AVES	PODARGIDAE	<i>Podargus strigoides</i>	Tawny Frogmouth		x			
AVES	PODICIPEDIDAE	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		x			
AVES	PSITTACIDAE	<i>Barnardius zonarius</i>	Australian Ringneck	x	x			
AVES	PSITTACIDAE	<i>Neophema elegans</i>	Elegant Parrot		x			
AVES	PSITTACIDAE	<i>Parvipsitta porphyrocephala</i>	Purple-Crowned Lorikeet		x			
AVES	PSITTACIDAE	<i>Platycercus icterotis</i>	Western Rosella	x	x			
AVES	PSITTACIDAE	<i>Platycercus spurius</i>	Red-Capped Parrot		x			
AVES	RALLIDAE	<i>Porphyrio porphyrio</i>	Purple Swamphen		x			
AVES	RALLIDAE	<i>Porzana tabuensis</i>	Spotless Crake		x			
AVES	RHIPIDURIDAE	<i>Rhipidura albiscapa</i>	Grey Fantail	x	x			
AVES	RHIPIDURIDAE	<i>Rhipidura leucophrys</i>	Willie Wagtail	x	x			
AVES	SCOLOPACIDAE	<i>Calidris (Ereunetes) ruficollis</i>	Red-Necked Stint		x			
AVES	STRIGIDAE	<i>Ninox novaeseelandiae</i>	Southern Boobook		x			
AVES	SULIDAE	<i>Morus serrator</i>	Australasian Gannet		x			
AVES	THRESKIORNITHIDAE	<i>Threskiornis molucca</i>	Australian White Ibis	x	x			
AVES	THRESKIORNITHIDAE	<i>Threskiornis spinicollis</i>	Straw-Necked Ibis		x			
AVES	TIMALIIDAE	<i>Zosterops lateralis</i>	Silvereye	x	x			
AVES	TYTONIDAE	<i>Tyto novaehollandiae</i>	Masked Owl		Possible	P3		
MAMMALIA	DASYURIDAE	<i>Antechinus flavipes subsp. leucogaster</i>	Yellow-footed Antechinus		x			
MAMMALIA	DASYURIDAE	<i>Dasyurus geoffroii</i>	Chuditch		x	T	VU	VU
MAMMALIA	DASYURIDAE	<i>Phascogale tapoatafa</i>	Brush-Tailed Phascogale		x	CD		
MAMMALIA	DASYURIDAE	<i>Sminthopsis fuliginosus</i>	Dusky Dunnart		x			

Class	Family	Scientific Name	Vernacular Name	Observed	Local records	Status	WA Status	EPBC Status
MAMMALIA	LEPORIDAE	<i>Oryctolagus cuniculus</i>	Rabbit*	x				
MAMMALIA	MACROPODIDAE	<i>Notamacropus irma</i>	Western Brush Wallaby		x	P4		
MAMMALIA	MACROPODIDAE	<i>Setonix brachyurus</i>	Quokka	Possible	x	T	VU	VU
MAMMALIA	MACROPODIDAE	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	x				
MAMMALIA	MURIDAE	<i>Hydromys chrysogaster</i>	Water-Rat	Possible	x	P4		
MAMMALIA	MURIDAE	<i>Mus musculus</i>	House Mouse*		x			
MAMMALIA	MURIDAE	<i>Rattus fuscipes</i>	Western Bush Rat		x			
MAMMALIA	MURIDAE	<i>Rattus rattus</i>	Black Rat*		x			
MAMMALIA	PERAMELIDAE	<i>Isodon fusciventer</i>	Southern Brown Bandicoot		x	P4		
MAMMALIA	PSEUDOCHEIRIDAE	<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum		x	T	CR	CR
MAMMALIA	VESPERTILIONIDAE	<i>Falsistrellus mackenziei</i>	Western False Pipistrelle		x	P4		
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		x			
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus gouldii</i>	Gould's Wattled Bat		x			
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus major</i>	Greater Long-eared Bat		x			
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus morio</i>	Chocolate Wattled Bat		x			
MAMMALIA	VESPERTILIONIDAE	<i>Vespadelus regulus</i>	Southern Forest Bat		x			
REPTILIA	CHELIDAE	<i>Chelodina colliei</i>	Oblong Turtle		x			
REPTILIA	ELAPIDAE	<i>Notechis scutatus</i>	Tiger Snake		x			
REPTILIA	GEKKONIDAE	<i>Christinus marmoratus</i>	Marbled Gecko		x			
REPTILIA	SCINCIDAE	<i>Acritoscincus trilineatus</i>	Western Three-Lined Skink		x			
REPTILIA	SCINCIDAE	<i>Ctenotus labillardieri</i>	Common South-West Ctenotus		x			
REPTILIA	SCINCIDAE	<i>Egernia kingii</i>	King's Skink		x			
REPTILIA	SCINCIDAE	<i>Egernia napoleonis</i>	South-Western Crevice-Skink		x			
REPTILIA	SCINCIDAE	<i>Hemiergis peronii</i>	Lowlands Earless Skink		x			
REPTILIA	SCINCIDAE	<i>Lissolepis luctuosa</i>	Western Mourning Skink		x			
REPTILIA	SCINCIDAE	<i>Menetia greyii</i>	Common Dwarf Skink		x			
REPTILIA	SCINCIDAE	<i>Tiliqua rugosa</i>	Bobtail		x			
REPTILIA	SCINCIDAE	<i>Morethia lineocellata</i>	West Coast Morethia Skink	x				

Appendix D Naturemap and PMST database results

NatureMap Species Report

Created By Guest user on 04/05/2020

Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)

Current Names Only Yes

Core Datasets Only Yes

Species Group All Animals

Method 'By Circle'

Centre 115° 17' 04" E, 33° 56' 40" S

Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	24731	<i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
2.	24733	<i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
3.	24734	<i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
4.	48400	<i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
5.	33940	<i>Cherax tenuimanus</i> (Margaret River hairy marron, Margaret River Marron)		T	
6.	24092	<i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
7.	33945	<i>Engaewa pseudoreducta</i> (Margaret River Burrowing Crayfish)		T	
8.	24189	<i>Falsistrellus mackenziei</i> (Western False Pipistrelle, Western Falsistrelle)		P4	
9.	34026	<i>Galaxiella munda</i> (mud minnow, western dwarf galaxias)		T	
10.	34030	<i>Geotria australis</i> (Pouched Lamprey)		P3	
11.	24215	<i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
12.	48588	<i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
13.	24557	<i>Leipoa ocellata</i> (Malleefowl)		T	
14.	24168	<i>Macrotis lagotis</i> (Bilby, Dalgite, Ninu)		T	
15.	34033	<i>Nannatherina balstoni</i> (Balston's Pygmy Perch)		T	
16.	48022	<i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
17.	48070	<i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
18.	24166	<i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
19.	33995	<i>Trichosternus relictus</i> (a ground beetle (Margaret River), beetle)		P3	
20.	34113	<i>Westralunio carteri</i> (Carter's Freshwater Mussel)		T	

Conservation Codes

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

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



EPBC Act Protected Matters Report

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

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

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

Report created: 19/11/20 14:38:50

[Summary](#)

[Details](#)

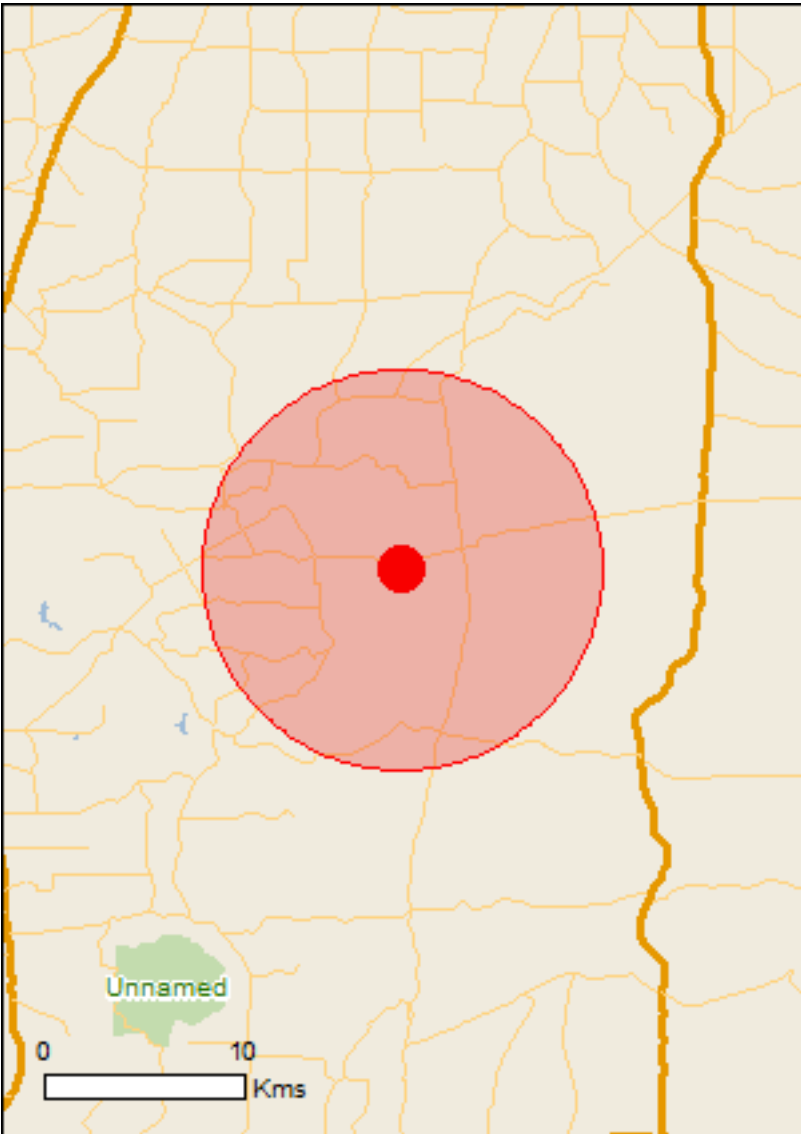
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

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

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name		Proximity
Vasse-wonnerup system		20 - 30km upstream

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
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 known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Crustaceans		
Cherax tenuimanus Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat known to occur within area
Engaewa pseudoreducta Margaret River Burrowing Crayfish [82674]	Critically Endangered	Species or species habitat known to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Geocrinia vitellina Orange-bellied Frog [26172]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
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 may occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Banksia mimica Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Reedia spathacea Reedia [2995]	Critically Endangered	Species or species habitat may occur within area

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

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		area 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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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

Name
Commonwealth Land -

Listed Marine Species	[Resource Information]
-----------------------	--

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat 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
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

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		area 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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Blackwood River	WA
NTWA Bushland covenant (0037)	WA
Rapids	WA

Regional Forest Agreements	[Resource Information]
Note that all areas with completed RFAs have been included.	
Name	State
South West WA RFA	Western Australia

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.94532 115.28482

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](#)
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- [-State Herbarium of South Australia](#)
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- [-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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Appendix E Threatened fauna evaluation

Table 1) below provides an evaluation of the presence of habitat and the likelihood of occurrence for conservation significant (target) fauna species. The species list was derived species lists from database searches (ALA, Birddata, IBSA, Naturemap and PMST reporting tool, 2020), literature and expert consultation, assessed against habitat observed within the study area. The potential to be impacted depends on the final nature of the final impacts proposed, habitat utilised by the target species and the likelihood of occurrence.

In the evaluation, the presence of habitat is given three categories:

- **Present:** Potential or known habitat is present within the project area.
- **Marginal:** Habitat present is not typical but may be suitable, or habitat is typical, but condition and microhabitat requirements of species are not present.
- **Absent:** No potential or known habitat is present within the project area.

There are four categories for likelihood of occurrence:

- **Nil:** Species known or predicted to occur within the locality but no suitable habitat within the project area.
- **Unlikely:** Species known or predicted within the locality. Suitable habitat may be present in the project area, but the proximity of nearest records suggests it is unlikely to occur.
- **Possible:** Suitable habitat present and the species could occur in the project area based on the proximity of nearest records.
- **Present:** Species was recorded during the field investigations

The following have been excluded from the tables as they are not relevant to the proposal or would not be impacted:

- Marine (e.g. seals, dolphins, whales, penguins).
- Marine migratory species (e.g. Albatrosses) or where breeding is in the northern hemisphere, e.g. those from the family Scolopacidae: Sandpipers and other shorebirds and waders.
- Species considered regionally extinct (e.g. Malleefowl).

Conservation status is as per the (federal) EPBC Act and (WA) DBCA Parks and Wildlife Service's Threatened and Priority Fauna List last updated 10/04/2019, under the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* made by the Minister for Environment under section 14(4) Part 2 of *Biodiversity Conservation Regulations 2018*.

Refer to Appendix B for Conservation Codes.

Table 1) Evaluation of the presence of habitat and the likelihood of occurrence for conservation fauna significant species within the study area

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
AMPHIBIANS	MYOBATRACHIDAE <i>Geocrinia alba</i>	White-bellied Frog	CR	EN	No records within 10 km. Records appear to occur within the McCleod Creek and Chapman Brook catchments of the Blackwood River. The distribution of the White-bellied Frog is extremely restricted and fragmented and is contained within an area north and west of the Blackwood River between Margaret River and Augusta in the extreme south-west of Western Australia (Roberts et al. 1999), south of the site. The extent of occurrence of the species is approximately 130 km ² . The area of occupancy for the White-bellied Frog is less than 2.5 km ² (Roberts et al. 1999). <i>Geocrinia alba</i> inhabit swampy flows along drainage depressions in an area of subdued topography (relief < 80m) near the junction of the Leeuwin-Naturaliste Ridge and Blackwood Plateau. Breeding sites are typically associated with sandy soils, dense overstorey vegetation dominated by <i>Homalospermum firmum</i> , <i>Agonis linearifolia</i> , <i>Astartea fascicularis</i> , and a dense ground layer of rhizomatous vegetation, usually composed of <i>Pseudoloxocarya sp.</i> , <i>Loxocarya sp.</i> and <i>Tetrarrhena laevis</i> (DPAW 2014).	Marginal	Unlikely
	<i>Geocrinia vitellina</i>	Orange-bellied Frog	VU	VU	Not previously recorded within 10km. <i>Geocrinia vitellina</i> extent of occurrence is calculated to be 6km ² with an area of occupancy based on suitable habitat estimated at 0.08km ² . The entire range of <i>G. vitellina</i> lies within the Blackwood River National Park, an area managed by Department of Parks and Wildlife and relatively free from major modification (DPAW 2014).	Marginal	Unlikely, given outside of the species known range
AVES	ARDEIDAE <i>Ixobrychus flavicollis</i>	Black Bittern		P2	Found in both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation, e.g. shadowy leafy waterside trees: casuarinas, eucalypts, paperbarks, tidal creeks and mudflats. In the case that	Marginal	Unlikely

					permanent water is present, the species may also occur in flooded grassland or adjacent forest and woodland. It nests on a sheltered horizontal branch over water (Pizzey and Knight 2007). There is a 2001 record from the Bramley National Park about 15km west of the site (Naturemap 2020).		
	CACATUIDAE <i>Calyptrorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	The Forest Red-tailed Black Cockatoo inhabits the dense Jarrah, Karri and Marri forests receiving more than 600 mm rainfall annually (SPRAT 2018). The FRTBC occurs within the same habitat as the Baudin's Cockatoo. FRTBC nest in Jarrah, Karri, Marri and Wandoo favouring large top entry hollows with entrances ranging from 12–14 cm in diameter and hollow depth one to five metres (SEWPaC, 2012) (Johnson and Kirkby, Undated). It breeds between February to December (with a peak between October and December, also a peak in some years in April–May) probably every two years – on the Swan Coastal Plain breeding has been recorded in November–December (Johnson and Kirkby, Undated). The species predominately feeds on seeds from Marri and Jarrah fruits and Blackbutt, Albany Blackbutt, Forest Sheoak, Snottygobble and the non-indigenous native Spotted Gum and Cape Lilac within its home range of about 116-187 ha (SPRAT 2018).	Present	Present
	<i>Calyptrorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN	Baudin's Cockatoo is mainly found in eucalypt forests, especially Jarrah -Marri forest, Karri forest, and less frequently in woodlands of Wandoo, Blackbutt, Flooded Gum Yate, partly cleared farmlands and urban areas including roadside trees and house gardens. This cockatoo forages at all levels of the forest from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground (Johnson and Kirkby, Undated). Preferred roosts are in areas with a dense canopy close to permanent sources of water (SPRAT 2018). The range of the species during the non-breeding season (breeds in August though to late December) may be determined by the distribution of Marri, and that nesting might be confined to	Present	Present

					areas in which Karri occurs (SPRAT 2018). It is known to nest in hollows of Eucalypts usually at some height (Pizzey and Knight 2007), often 30-50m above ground (Jupp 2000). Tree hollows usually have an entrance of 30-40cm, >30cm deep and are mostly vertical (SPRAT 2018) (Johnson and Kirkby, Undated).		
	<i>Calyptrorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	<p>This species is a postnuptial nomad, moving west after breeding. Carnaby's Cockatoo mainly occurs in or near eucalypt woodlands, especially those dominated by Wandoo or Salmon Gum, and sometimes reported in forests of Marri, Jarrah, Karri and Tuart. Nesting hollows may be located anywhere from 2 m to >10 m from ground, mainly in the Wheatbelt (Cale 2003, SPRAT 2009, WA Museum 2010).</p> <p>It is known to forage in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp. Forages in pine plantations, eucalypt woodland and forest that contains foraging species. Also individual trees and small stands of these species (SEWPAC 2012).</p> <p>This species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain. This may be due to climate change. Breeding occurs mainly from early July to mid-December. Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick, for example adjacent pine forest or remnant vegetation (Johnson and Kirkby, Undated).</p>	Present	Present
	FALCONIDAE <i>Falco peregrinus</i>	Peregrine Falcon	-	OS	Peregrine Falcons occur in woodland, plains, gorges, wetlands but tend to breed either in stick-nests in trees or nest on cliff ledges. It appears that hollows and large abandoned nests of other birds may be used where cliff ledges are limited. Breeds Aug-Dec. Where good habitat occurs, and the density of Peregrine Falcons is high, active nests may occur within 2.5km of each other. The diet of the Peregrine Falcon includes wood duck, pigeons and doves,	Present	Possible visitor

					galahs, rosellas and cockatoo, starlings and larks (Olsen et al. 2006).		
	STRIGIDAE <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i>	Masked Owl (southern subsp)	-	P3	Inhabits forests, open woodlands and farmlands with large trees, including timber watercourses paperbark woodlands. Widespread but very sparse, they breed any time of the year when conditions are favourable with a nesting period of about three months (Pizzey and Knight 2007).	Present	Possible visitor
	DASYURIDAE <i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Quolls may occupy a range of habitats including forest, woodland and desert, though in the SW they are largely restricted to Jarrah forest or scattered through the southern and eastern wheat belt (DEC 2010). Current records indicated that this only represents approximately 5% of their former range. Habitat critical to Western Quoll are large areas of undisturbed habitat which a sufficient variety of key food and other resources such as large hollow logs, burrows or small caves at ground level for denning. To be suitable as den sites, logs must have a diameter of at least 30 cm but usually greater than 50 cm, a hollow diameter of 7–20 cm and generally 1m long (Orell & Morris 1994). Annually, an adult female Chuditch will utilise an estimated average of 66 logs and 110 burrows within her home range. A large amount of den sites is required for both sexes. They occupy relatively large home ranges, with males utilizing over 15 km ² and females, 3–4 km ² (Orell & Morris 1994). There are numerous local records including a 2008 record at the property entrance (Naturemap 2020).	Present	Possible
MAMMALS	<i>Phascogale tapoatafa</i>	Southern Brush-tailed Phascogale	-	S	This arboreal species is found in a variety of forest types. Ideal habitat for this species consists of dry sclerophyll forest and open woodland (Jarrah, Marri, and mixed Jarrah Karri) that contain hollow bearing trees and sparse ground cover. Their many nesting sites include hollow tree limbs, rotten stumps and even birds' nests. Lactating females prefer a large tree cavity with a small entrance with a nest made of bark, feathers and fur. A female's home range covers 20 to 70 hectares, a male's home ranges over laps females and increases during breeding season. It is predominantly carnivorous, foraging on	Present	Possible

					arthropods, invertebrates, small vertebrates and nectar (Strahan 1995).		
	MACROPODIDAE <i>Notamacropus irma</i>	Western Brush Wallaby		P4	Optimum habitat for the Western Brush Wallaby includes open Jarrah forest or woodland and seasonally wet flats with low grasses and scrubby thickets, but also areas of mallee and heathland. Common dietary flora includes <i>Carpobrotus edulis</i> , <i>Cynodon dactylon</i> and <i>Nuytsia floribunda</i> (DEC, 2012). There are several local records in Naturemap (2020).	Present	Possible
	<i>Setonix brachyurus</i>	Quokka	VU	VU	<p>The understorey structure of the habitats currently used by Quokka consist of dense, low vegetation that provides refuge from predation (Hayward 2002). The mainland habitats include dense riparian vegetation (Hayward et al. 2005), but also (from SPRAT 2017)</p> <ul style="list-style-type: none"> • heath and shrubland, • Swamp Peppermint (<i>Taxandria linearifolia</i>) dominated swamps in Jarrah forest, • swampy shrublands, • swordgrass-dominated understorey, • regrowth areas of the Karri forest, • Bullich swamp forest, • Paperbark (<i>Melaleuca</i> spp.) swamp. <p>A low density of near-surface fuel, a complex vegetation structure and a varied fire-age mosaic best predict the probability of occupancy of quokka in the southern forest (DEC 2013). The Bullich swamp forest in the drainage line in the southern site has similarities to southern forest habitats. The nearest database record is a 2008 record from the Blackwood State Forest about 10km east of the site (Naturemap 2020).</p>	Present	Possible
	MURIDAE <i>Hydromys chrysogaster</i>	Water Rat	-	P4	The Water rat is usually found in permanent fresh or brackish water but can be found in marine environments. Fresh water habitats include swamps, lakes, dams even urban drainage swamps. Typically forages close to the shoreline, restricting	Present	Possible

					its movements to shallow water (up to 2 m in depth) (CSIRO, 2004). The nearest records are associated with Margaret River about 6.5 km north of the site. A possible feed middle was found in the northern site.		
	PERAMELIDAE <i>Isodon obesulus fusciventer</i>	Southern Brown Bandicoot	-	P4	Bandicoot habitat consists of dense scrubby, often swampy vegetation with a dense cover up to one metre high particularly near watercourses/wetlands. It often feeds in adjacent forest (Jarrah and Wandoo) and woodlands that are burnt on a regular basis. Nests can be concealed next to or under old logs, shrubs or piles of debris and are made up of ground litter piled up over a shallow depression providing internal chambers. Home ranges vary with population density and range from 5-8.6 ha for males and 1-6 ha for females (DEC 2010). Feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous fungi. Their searches for food often create distinctive conical holes in the soil (DECC 2010). There are local records to the west of the site (Naturemap 2020). No evidence observed.	Present	Possible
	PSEUDOCHEIRIDAE <i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	Present populations mostly inhabit Peppermint and Peppermint-Tuart associations from Bunbury to Albany (SPRAT 2018). In dense, coastal Peppermint forest, home ranges are about 0.5 hectares to 1.5 ha and in eucalypt forests about 2.5 ha. In the northern jarrah forests, home ranges are larger and have been recorded to at least 5.6 ha. Peppermint leaves form the basis of the WRP diet in coastal areas (between 79-100% based on a study of WRP near Busselton by Jones et al. 1994), but when unavailable, the dominant myrtaceous species are preferred. In the inland forest, Jarrah and Marri the main food source. Garden plant varieties are also exploited in urban areas. WRP use a range of nest and shelter sites to avoid predators and exposure to the weather. Dreys are constructed in the canopy if hollows are not available. Adequate nest and shelter sites are necessary components of good quality habitat (Jones 1994, Shedley and Williams 2014).	Present	Unlikely

					Spatial records appear to stop approximately 9km west of the site in Naturemap (2020), this is supported by recent regional surveys by Biota (2019) where there were no individuals found in either North East Margaret River State Forest or Woodjup National Park (10 Mile Brook Dam).		
	VESPERTILIONIDAE <i>Falsistrellus mackenziei</i>	Western False Pipistrelle	-	P4	It occurs in wet sclerophyll forest dominated by Karri (<i>Eucalyptus diversicolor</i>), and in the high rainfall zones of the Jarrah (<i>E. marginata</i>) and Tuart (<i>E. gomphocephala</i>) forests. It has also been recorded in mixed Tuart-Jarrah tall woodlands on the adjacent coastal plain. Marri (<i>E. calophylla</i>), Sheoak (<i>Casuarina heugeliana</i>) and Peppermint (<i>Agonis flexuosa</i>) trees are often co-dominant at its collection localities (DotEE, 2018). This species roosts in tree hollows (Phillips & Inwards 1985) in colonies of 5 to 30 bats (Aust Museum, 2009). The species feed on flying insects between below the forest canopy. There are several 2018 records north of the site (7.5km) associated with Margaret River (Naturemap 2020)	Present	Possible
	GALAXIIDAE <i>Galaxiella munda</i>	Mud minnow, Western dwarf galaxias	-	VU	Occur in slow-running, tea-colored streams usually in sandy areas. Also found in swamps, small ponds and roadside ditches. Also lives in the vegetated shallows of some freshwater lakes. Water is typically acidic (pH 4.5-6.5) and darkly tannin-stained. An inhabitant of temporary waters, capable of aestivating in damp bottom sediments over summer (Allen et al 2002) (Smith et al 2002). Several records in the upper Margaret River (DWER 2020) (Naturemap 2020).	Present	Possible
Fish	GEOTRIIDAE <i>Geotria australis</i>	Pouched Lamprey	-	P3	Found between Margaret River and Denmark. After metamorphosis, young adults migrate downstream to estuaries and coastal waters, where they feed parasitically by rasping flesh from other fishes with their toothy tongues. They eventually cease feeding and migrate back to freshwater to breed (Gomon and Bray, 2011). The species has not been found in the local catchment this far upstream (DWER 2020).	Marginal	Unlikely

	PERCICHTHYIDAE <i>Nannatherina balstoni</i>	Balston's Pygmy Perch	VU	VU	Balston's Pygmy Perch is a small freshwater fish that grows to a maximum length of around 90 mm (commonly 60 mm). This species is brownish dorsally and silver below, usually with a prominent brown mid-lateral stripe and a series of vertical brown bars on sides giving a cross-hatched pattern. Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west WA, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (SPRAT 2018) (Bray et al. 2018). Associated with slow-flowing, low salinity, acidic and tannin-stained waters, and complex instream habitat – recorded locally (DWER 2020).	Present	Possible
Invertebrates	CARABIDAE <i>Trichosternus relictus</i>	a ground beetle Margaret River	-	P3	Has been found under logs in Eucalyptus woods (Bennelongia Pty Ltd, 2013).	Present	Possible
	HYRIIDAE <i>Westralunio carteri</i>	Carters Freshwater Mussel	VU	VU	Carters Freshwater Mussel is the only freshwater mussel found in southwest WA. It is a bivalve found in freshwater streams, rivers, billabongs, ponds, wetlands and lakes inland from the coast mostly areas with muddy, silty and sandy bottoms and flowing permanent water. Tracks can be seen along banks and sandy/muddy patches of stream bed where they are present. Native fish are critical to the Mussel's lifecycle - larval mussels attach themselves to native fish to spread their population and develop into juvenile mussels. Mussels move along the bottom using a muscular tongue-like appendage known as a foot. Unlike their marine and estuarine cousins, they do not attach to structures. This allows them to move with receding water levels and position themselves to the best feeding spots (Murdoch University, 2010). Modelled as likely to be found locally (DWER 2020), though not observed at the site and probably unlikely due to the lack of suitable habitat – pools and fish, and degraded habitat downstream between the site and Margaret River.	Marginal	Unlikely
	PARASTACIDAE <i>Cherax tenuimanus</i>	Margaret River hairy marron	CR	CR	The Hairy Marron only occurs in the Margaret River and upper headwaters in the SW of WA. Prefers fresh, highly	Marginal	Unlikely

oxygenated, clear-water habitats of the Margaret River, with complex shelter including large woody debris which it also utilises as a food source. It is omnivorous, feeding on both plant and animal matter (DWER 2020). Modelled as likely to be found locally (DWER 2020) though the seasonal nature of the Mowen River and degraded habitat downstream between the site and Margaret River indicate it is probably unlikely to occur.

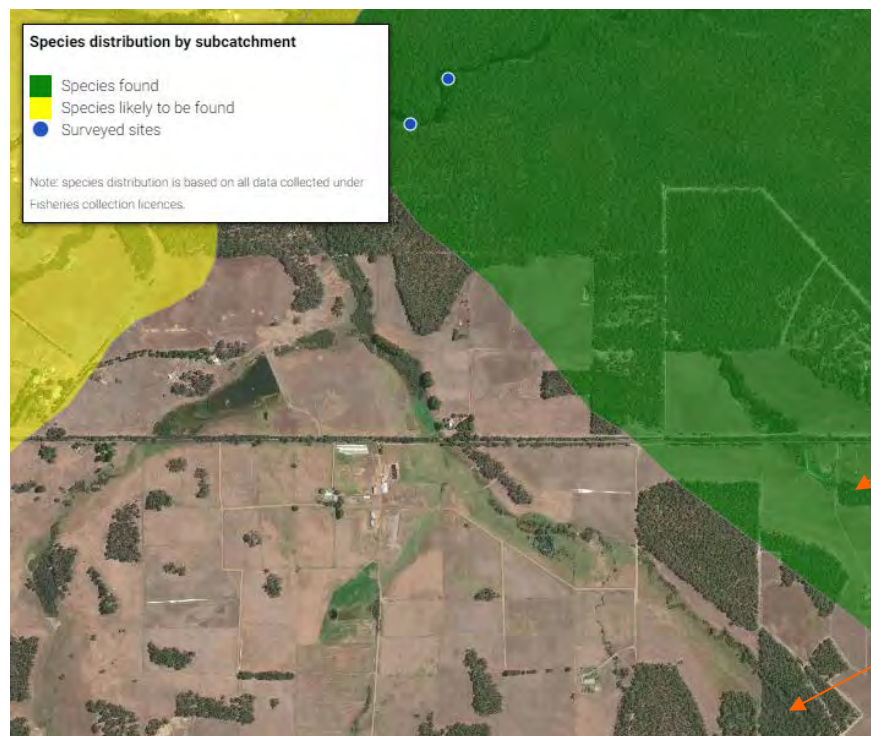


Figure E.1 Margaret River Hairy Marron Health Rivers records (DWER 2020).
 The proposed dam locations are shown with the arrows.

	<i>Engaewa pseudoreducta</i>	Margaret River Burrowing Crayfish	CR	CR	<p>The Margaret River Burrowing Crayfish is endemic to south-west WA and occurs in two subpopulations, Treeton and Payne Road.</p> <p>At Treeton, it occurs in and adjoining State Forest No. 62 (Burnham 2014), in swampy headwaters of a tributary of the Margaret River, Osmington, about 9km north west of the site (Naturemap 2020). A burrow was found in the Bramley National Park. It is known from two sites in the area with individuals collected in 2003 and 2007 (Burnham et al. 2012). At Payne Road, the species occurs in Carburnup River catchment (south-east of Dunsborough), 16 km north of the Treeton Reserve sites (Burnham et al. 2012). No characteristic chimneys were observed though the species' cryptic, burrowing nature, the difficulty seeing and accessing burrows in often dense vegetation make it difficult to survey for.</p>	Marginal at the southern site.	Unlikely, Extremely restricted range.
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Appendix F Suitable DBH Trees

Table 7-1 Suitable DBH trees and hollows within the study area

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
20	6242912	341572	dead	50 75											Northern
26	6242923	341484	dead	50 75											Northern
30	6242920	341441	dead	<50	1 hollow	not likely	10 15cm	vertical	<10m	no evidence of use					Northern
41	6242818	341605	dead	<50	2 hollows	not likely	10 15cm	knot angle suitable	10 15m	no evidence of use	<10cm	knot angle suitable	10 15m	no evidence of use	Northern
43	6242834	341604	dead	50 75											Northern
49	6242845	341585	dead	<50	1 hollow	not likely	<10cm	spout angle suitable		cavity too small					Northern
103	6242177	341223	dead	<50	1 hollow	potential	10 15cm	knot angle suitable	<10m	no evidence of use					Southern
109	6242185	341195	dead	50 75											Southern
110	6242184	341187	dead	50 75	1 hollow			spout angle suitable	<10m	no evidence of use					Southern
127	6242162	341204	dead	50 75	1 hollow	not likely	15 20	vertical	10 15m						Southern
137	6242283	341204	dead	50 75	2 hollows	not likely	10 15cm	knot angle suitable		no evidence of use	10 15cm	spout angle suitable		no evidence of use	Southern
5	6242891	341446	jarrah	50 75											Northern
7	6242890	341475	jarrah	50 75											Northern
8	6242886	341498	jarrah	50 75											Northern
9	6242899	341494	jarrah	50 75											Northern
10	6242896	341504	jarrah	<50	1 hollow	not likely	10 15cm	knot angle suitable	<10m	no evidence of use					Northern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
11	6242901	341506	jarrah	50 75	1 hollow	not likely	<10cm	knot angle suitable	10 15m	no evidence of use					Northern
14	6242883	341507	jarrah	50 75											Northern
15	6242878	341532	jarrah	50 75	1 hollow	not likely	10 15cm	spout angle suitable		no evidence of use					Northern
21	6242911	341570	jarrah	50 75											Northern
31	6242919	341475	jarrah	<50	1 hollow	not likely	<10cm	knot angle suitable	<10m	no evidence of use					Northern
32	6242913	341496	jarrah	50 75											Northern
33	6242913	341498	jarrah	50 75	1 hollow	not likely	<10cm	knot angle suitable	10 15m	no evidence of use					Northern
34	6242921	341501	jarrah	<50	1 hollow	not likely	<10cm	spout angle not suitable	<10m	cavity too small					Northern
35	6242820	341555	jarrah	50 75	2 hollows	not likely	<10cm	spout angle suitable	10 15m	no evidence of use	<10cm	spout angle suitable	10 15m	cavity too small	Northern
36	6242786	341630	jarrah	50 75											Northern
39	6242807	341631	jarrah	75 100											Northern
40	6242808	341621	jarrah	50 75											Northern
42	6242830	341605	jarrah	50 75	2 hollows	potential	10 15cm	knot angle suitable	10 15m	no evidence of use	10 15cm	knot angle suitable	<10m	no evidence of use	Northern
44	6242842	341607	jarrah	50 75											Northern
45	6242839	341594	jarrah	50 75	1 hollow	potential	15 20	knot angle suitable		no evidence of use					Northern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
46	6242837	341590	jarrah	50 75	2 hollows	potential	10 15cm	knot angle suitable		chews fresh,othe r	10 15cm	knot angle suitable		no evidence of use	Northern
47	6242834	341588	jarrah	50 75											Northern
48	6242851	341589	jarrah	50 75											Northern
50	6242845	341571	jarrah	50 75	1 hollow	not likely	10 15cm	spout angle suitable		no evidence of use,other					Northern
52	6242840	341566	jarrah	50 75											Northern
54	6242828	341556	jarrah	50 75	1 hollow	not likely	10 15cm	spout angle suitable		cavity too small					Northern
56	6242824	341566	jarrah	50 75											Northern
57	6242816	341568	jarrah	50 75											Northern
60	6242813	341579	jarrah	<50	1 hollow	not likely	<10cm	knot angle suitable		no evidence of use					Northern
61	6242819	341580	jarrah	50 75											Northern
62	6242815	341592	jarrah	50 75											Northern
64	6242794	341604	jarrah	50 75											Northern
65	6242863	341594	jarrah	50 75											Northern
67	6242817	341649	jarrah	50 75											Northern
68	6242809	341648	jarrah	50 75											Northern
69	6242798	341648	jarrah	50 75											Northern
71	6242801	341654	jarrah	50 75											Northern
72	6242074	341427	jarrah	50 75											Southern
77	6242095	341352	jarrah	50 75											Southern
78	6242101	341348	jarrah	50 75											Southern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
79	6242105	341346	jarrah	50 75											Southern
81	6242120	341329	jarrah	>100	2 hollows	potential	15 20	spout angle suitable	10 15m		15 20cm	knot angle suitable			Southern
82	6242128	341336	jarrah	50 75											Southern
86	6242136	341303	jarrah	50 75											Southern
88	6242155	341308	jarrah	50 75											Southern
89	6242157	341336	jarrah	50 75	1 hollow	not likely	10 15cm	knot angle suitable	10 15m	no evidence of use					Southern
93	6242157	341304	jarrah	50 75											Southern
95	6242157	341296	jarrah	50 75	1 hollow	not likely	<10cm	knot angle suitable	knot angle suitable	no evidence of use					Southern
98	6242141	341272	jarrah	50 75											Southern
99	6242160	341267	jarrah	50 75											Southern
100	6242160	341239	jarrah	50 75											Southern
101	6242157	341234	jarrah	75 100	1 hollow	potential	15 20	vertical	<10m	no evidence of use					Southern
102	6242173	341227	jarrah	50 75											Southern
104	6242182	341224	jarrah	50 75											Southern
105	6242186	341224	jarrah	50 75											Southern
106	6242188	341227	jarrah	50 75											Southern
108	6242187	341207	jarrah	50 75											Southern
111	6242212	341176	jarrah	50 75	1 hollow	not likely	<10cm	knot angle not suitable	<10m						Southern
113	6242104	341197	jarrah	50 75											Southern
114	6242107	341197	jarrah	50 75											Southern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
115	6242106	341198	jarrah	50 75											Southern
116	6242094	341208	jarrah	50 75											Southern
117	6242102	341210	jarrah	50 75											Southern
118	6242115	341187	jarrah	50 75											Southern
120	6242125	341190	jarrah	50 75											Southern
121	6242127	341205	jarrah	50 75											Southern
122	6242128	341192	jarrah	<50	1 hollow	not likely	<10cm	vertical	<10m						Southern
125	6242170	341196	jarrah	50 75											Southern
126	6242182	341190	jarrah	50 75											Southern
128	6242137	341230	jarrah	50 75											Southern
130	6242128	341223	jarrah	50 75											Southern
131	6242120	341222	jarrah	50 75											Southern
132	6242123	341211	jarrah	50 75											Southern
133	6242118	341215	jarrah	50 75											Southern
134	6242303	341191	jarrah	50 75											Southern
136	6242300	341202	jarrah	50 75											Southern
140	6242294	341229	jarrah	50 75											Southern
142	6242294	341233	jarrah	75 100											Southern
144	6242261	341256	jarrah	50 75											Southern
145	6242239	341244	jarrah	50 75	1 hollow	potential	15 20	vertical	10 15m	other					Southern
147	6242240	341285	jarrah	50 75	1 hollow	not likely	<10cm	spout angle not suitable	<10m	no evidence of use					Southern
150	6242232	341293	jarrah	50 75											Southern
151	6242193	341326	jarrah	50 75	1 hollow	not likely	<10cm	knot angle suitable	10 15m	no evidence of use					Southern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
152	6242174	341335	jarrah	75 100											Southern
153	6242137	341387	jarrah	>100	2 hollows	not likely	15 20	vertical	<10m	blocked or debris	10 15cm	knot angle suitable		no evidence of use	Southern
156	6242314	341205	jarrah	50 75											Southern
157	6242314	341212	jarrah	50 75											Southern
74	6242075	341369	bullich	50 75											Southern
75	6242080	341376	bullich	50 75											Southern
84	6242133	341317	bullich	50 75											Southern
138	6242296	341217	bullich	75 100											Southern
148	6242234	341284	bullich	50 75											Southern
6	6242883	341467	marri	50 75											Northern
16	6242863	341577	marri	50 75											Northern
17	6242880	341578	marri	50 75											Northern
18	6242886	341579	marri	75 100	1 hollow	not likely	20cm plus	vertical	10 15m	no evidence of use					Northern
19	6242901	341573	marri	50 75											Northern
22	6242905	341561	marri	50 75											Northern
23	6242909	341550	marri	50 75											Northern
24	6242926	341524	marri	50 75											Northern
25	6242927	341507	marri	50 75											Northern
29	6242927	341441	marri	50 75											Northern
37	6242790	341629	marri	50 75											Northern
51	6242847	341560	marri	50 75											Northern
53	6242838	341556	marri	50 75											Northern
55	6242824	341565	marri	50 75											Northern

Tree ID	y proj	x proj	Treesp	DBHcm	Hollows	Breedingl i	H1size (cm range)	H1type	H1 height (m range)	H1notes	H2size (cm range)	H2type	H2height (m range)	H2notes	Site
58	6242814	341569	marri	50 75											Northern
59	6242812	341576	marri	50 75											Northern
63	6242811	341580	marri	50 75											Northern
66	6242820	341646	marri	50 75											Northern
70	6242798	341635	marri	75 100											Northern
85	6242133	341317	marri	75 100											Southern
87	6242154	341296	marri	50 75											Southern
90	6242154	341313	marri	50 75											Southern
94	6242159	341299	marri	50 75											Southern
96	6242139	341278	marri	> 100	1 hollow	not likely	20cm plus	vertical	<10m	blocked or debris					Southern
97	6242139	341276	marri	50 75											Southern
107	6242190	341224	marri	50 75											Southern
119	6242117	341188	marri	50 75											Southern
123	6242137	341194	marri	50 75											Southern
124	6242162	341196	marri	50 75											Southern
129	6242133	341222	marri	50 75											Southern
135	6242294	341196	marri	75 100											Southern
139	6242286	341219	marri	75 100											Southern
141	6242297	341229	marri	50 75											Southern
143	6242288	341241	marri	50 75											Southern
149	6242228	341292	marri	50 75	1 hollow	potential	20cm plus	vertical	10 15m	chews fresh,other					Southern
154	6242131	341397	marri	50 75											Southern
155	6242320	341202	marri	50 75											Southern