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Byford
Public Transport Authority
19-Jun-2020

METRONET - Byford Extension Part One

Flora and Fauna Assessment

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Flora and Fauna Assessment

Client: Public Transport Authority

ABN: 61 850 109 576

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19-Jun-2020

Job No.: 60615333

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Quality Information

Document	METRONET - Byford Extension Part One
Ref	60615333
Date	19-Jun-2020
Prepared by	Floora De Wit and Jared Leigh
Reviewed by	Linda Kirchner

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	28-Feb-2020	Draft for Internal Review	Linda Kirchner Associate Director - Environment	
B	28-Feb-2020	Draft for Client Review	Linda Kirchner Associate Director - Environment	
0	19-Jun-2020	Final for Issue to Client	Linda Kirchner Technical Director - Environment	

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Executive Summary

The Public Transport Authority (PTA) engaged AECOM Australia Pty Ltd (AECOM) to undertake vegetation, flora and fauna surveys for a linear infrastructure corridor in Byford; the Byford Rail Extension (BRE). The linear corridor (the survey area) incorporates the existing Mundijong Train line between Gladstone Road, Armadale to Cardup Siding Road in Byford.

The surveys included a detailed flora and vegetation survey, level 1 fauna survey and black cockatoo survey. The assessments were undertaken simultaneously by one zoologist and one botanist on 8, 9, 16 and 19 November 2019. Tasks included conducting a desktop study, a field survey, and reporting component.

The detailed flora and vegetation assessment was conducted by Floora de Wit and included targeted flora and threatened community searches, sampling floristic data from 11 quadrats and 8 relevés, vegetation community mapping and condition mapping. In summary:

- Three TECs were identified and mapped including
    - *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) extending for 6.68 ha.
    - *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered) extending for 0.18 ha.
    - FCT8 Herb rich shrublands in claypans (EPBC Critically Endangered, WA Vulnerable) potentially occurs near Brickwood Reserve extending for 1.57 ha. Low confidence in this assessment, however TECs are known to occur adjacent and FCT analysis, hydrology and soil characteristics suggest it is present.
- No Threatened or Priority flora was recorded. Justification for this includes the narrow corridor of vegetation remaining after clearing, altered hydrology from the rail embankment, weed invasion, and historical disturbance associated with railway construction.

A level 1 fauna assessment was completed by Ecologist Jared Leigh and included fauna habitat mapping, assessing the potential presence of conservation significant fauna species, and recording fauna species via direct and indirect evidence. A targeted black cockatoo survey was also conducted that assessed breeding, roosting and foraging habitat. In summary:

- Four conservation significant fauna species were recorded including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (EPBC Act & WA Vulnerable), Carnaby's Cockatoo *Calyptorhynchus latirostris* (EPBC Ac & WA Endangered), Baudin's Cockatoo *Calyptorhynchus baudinii* (EPBC Act & WA Endangered) and Quenda *Isoodon fusciventer* (WA Priority 4)
- Seven (including Cleared) broadly defined fauna habitats were mapped. Other than cleared areas, the most common fauna habitat is the Eucalypt Woodland. This habitat is highly variable generally contains Marri *Corymbia calophylla* over an open shrubland over an open sedge layer. Habitat quality is considered high to moderate depending on the levels of degradation and modification, and the levels of complexity.
- Breeding foraging and potential roosting habitat is present for all three Western Australian threatened black cockatoo species which included 277 native (hollow-forming) breeding habitat trees comprising 73% (203) Marri, 26% (53) Flooded Gum, and the remaining were a mix of Jarrah, Stags, Tuart and Wandoo. Thirteen trees contained 13 potentially suitable hollows for black cockatoo breeding. Foraging habitat included:
    - 19.14 ha of High Quality and Very High Quality foraging habitat for Carnaby's Cockatoo *Calyptorhynchus latirostris* and Baudin's Cockatoo *Calyptorhynchus baudinii*
    - 14.42 ha of High Quality foraging habitat for Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia*.

The surveys were successfully completed with no significant limitations identified. The preliminary impact assessment demonstrates that the project is likely at variance with several of the ten clearing principles associated with biodiversity, threatened fauna habitat, threatened ecological communities, watercourses and wetlands, and potentially impact on environmental values of adjacent conservation reserves and clearing native vegetation in an area that has been extensively cleared.

Referral under the EPBC Act is likely to be required given the potential impact on black cockatoo foraging and breeding habitat, and three TECs. It is recommended that additional surveys be undertaken for two of the TECs where the inferred FCT had low confidence, including SCP3c and FCT8. Additional quadrat scoring events and targeted threatened flora surveys would ensure that accurate ecological data is used to inform the environmental assessment process.

1.0 Introduction

1.1 Background

The Public Transport Authority of Western Australia (PTA) are undertaking planning and research to extend the current Armadale train line from Armadale station to Byford, and potentially Mundijong. The rail extension planning is being under the State Government's METRONET project, and is referred to as the Byford Rail Extension project (BRE). The proposed line is within the existing regional rail reserve corridor, and has been divided into two parts:

- Part 1: Armadale to Byford
- Part 2: Byford to Mundijong.

AECOM Australia Pty Ltd (AECOM) were engaged by PTA to complete a detailed flora and vegetation survey, level 1 fauna survey and targeted black cockatoo survey for Part 1 of the Byford Rail Extension project (survey area).

1.2 Location

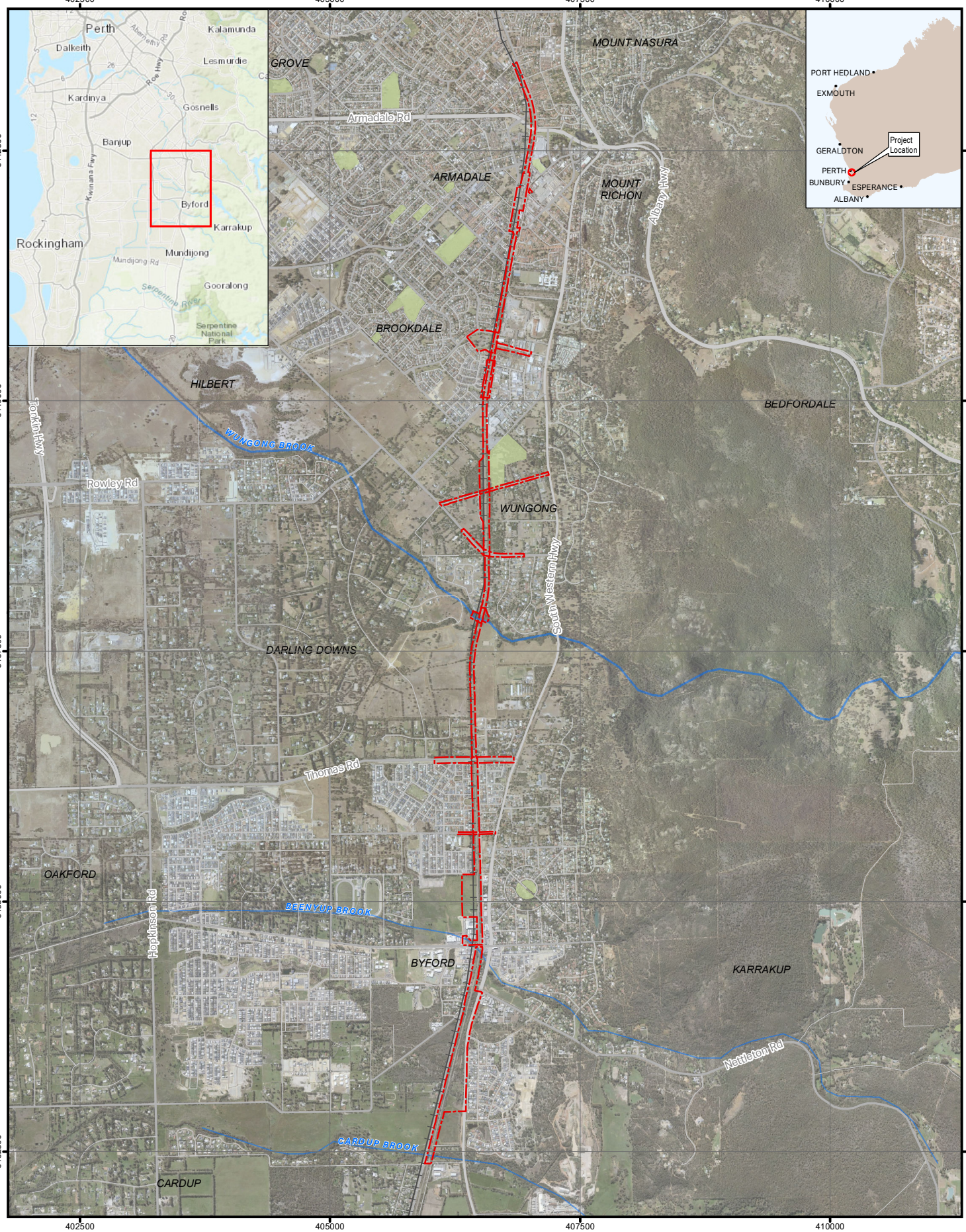
The survey area is approximately 10 ha and follows the regional rail reserve corridor from Gladstone Road, Armadale to Cardup Siding Road, Byford. The survey area starts approximately 25 km south-east of the Perth CBD, and extends for approximately 11 km through the City of Rockingham and the Shire of Serpentine-Jarrahdale. Refer to Figure 1 for further details.

1.3 Objectives

The purpose of the survey is to define the environmental values of the survey area to inform the environmental assessment and planning process and support environmental approval applications. This included an assessment against the ten clearing principles and recommendations for environmental approval requirements. The assessment accordingly included the collection of information relating to flora, vegetation, fauna and habitats.

The objective of the survey was to define and map the environmental values of the survey area. The survey included the collection of information relating to flora, vegetation, fauna and habitats.
The specific objectives of the assessment were to:

- undertake a comprehensive desktop assessment to define the existing environment and potential matters of conservation significance present in the survey area
- conduct a detailed flora and vegetation survey in accordance with the Flora Survey Technical Guide (EPA, 2016a)
- determine the presence or absence of Threatened (listed as Threatened (T) or Extinct (X)) or Priority flora and communities
- map and delineate vegetation units and vegetation condition
- conduct a Level 1 Fauna survey in accordance with the Fauna Survey Technical Guide (EPA, 2016b)
- undertake a Targeted Black Cockatoo Survey, including identification of potential breeding, roosting and foraging habitat and produce relevant mapping
- conduct a preliminary assessment against the ten clearing principles
- provide recommendations for environmental approval requirements (State and Commonwealth).



PROJECT ID	60615333
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	28 FEB 2020

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(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 200 400 600 800
Metres

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND
Survey Area

Survey Area

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure
1

Map Document: \\AUPER1FP001.au.aecomnet.com\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig1_SurveyArea_A4P_v1.mxd (wyattk2)

A4 size

2.0 Existing Environment

2.1 Climate

The survey area is located approximately 25 km south-east of Perth CBD in Western Australia. This region experiences a Mediterranean climate, which is characterised by warm to hot dry summers and mild to cool wet winters. The Mediterranean climate in Australia is a result of the Indian Ocean High, a high pressure cell that shifts towards the poles in summer and the equator in winter, playing a major role in the formation of the deserts of Western Australia, and the Mediterranean climate of southwest and south-central Australia. Precipitation occurs during winter months, with the possibility of some summer storms.

The nearest Bureau of Meteorology (BOM) weather station with comprehensive climate data is Gosnells City weather station (009106). Rainfall and average temperature data for 12 months prior to the survey along with historical data is displayed in Figure 2.

In the months preceding the October 2019 surveys, the rainfall was variable to the average, being slightly higher June, and lower than average from July to September. The low rainfall in September may influence flowering of some species, however this was not considered a limitation for this survey.

Maximum mean temperatures were near average from April to July, and deviated higher in August and September. Whilst the minimum mean temperatures were above average in June and July, and near average in August and September.

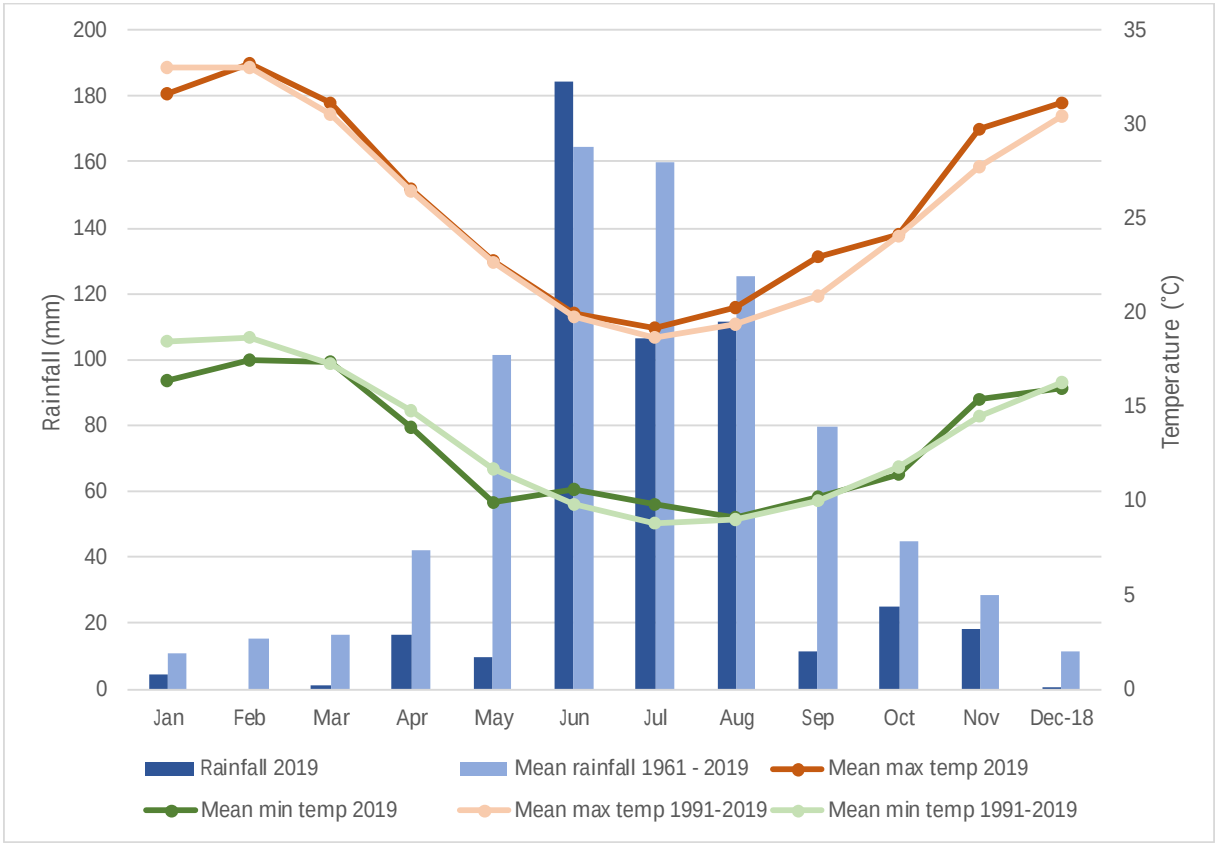

Figure 2 Rainfall data from Gosnells City weather station (009106) showing mean monthly rainfall and rainfall received in the 12 months preceding the field survey (source: BOM, 2020)

2.2 IBRA Regions

The largest regional vegetation classification scheme recognised by EPA is the Interim Biogeographical Region of Australia (IBRA). The IBRA regions provide the planning framework for the systematic development of a comprehensive, adequate and representative (CAR) national reserve system. There are 89 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Mitchell et al., 2002).

The survey area is situated in the Swan Coastal Plain 2 (SWA02), within the Swan Coastal Plain bioregion. The Swan Coastal Plain subregion, described by Mitchell et al. (2002), is a low-lying coastal plain covered with woodlands dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. The area includes a complex series of seasonal wetlands and includes Rottnest, Carnac and Garden Islands. Land use is predominantly cultivation, Conservation, urban and rural residential. The area contains a number of rare features including Holocene dunes and wetlands and a large number of rare and threatened species and ecological communities.

The Northern Jarrah Forest (JAF01) subregion is approximately 600m east of the survey area.

2.3 Vegetation

Beard (1979) and Heddle *et al*. (1980) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. EPA's objective is to retain at least 30% of all pre-European ecological communities, which is consistent with recognised retention levels (EPA, 2000; EPA, 2015).

The majority of the survey area is mapped as Vegetation Association 968: Medium woodland, with a small part comprising Vegetation Association 3: Medium forest (Beard, 1979). The Vegetation Association 968 has less than 10% remaining in the Swan Coastal Plan, and Vegetation Association 3 has less than 30% remaining (Govt. of WA, 2018). Refer to Table 1 for further details.

Vegetation complexes in the survey area have been defined by Heddle *et al*. (1980) and are based on vegetation in association with landforms and underlying geology. Two vegetation complexes as described by Heddle *et al.* (1980) occur within the Survey Area (Table 2).

Table 1 Beard Vegetation Association

Name	Vegetation Association	Description	Remaining in WA	Remaining in the SCP
Pinjarra	968	Medium woodland; jarrah, marri & wandoo	32.0%	6.6%
Pinjarra	3	Medium forest; jarrah-marri	67.8%	18.1%

Table 2 Heddle *et al.* (1980) Vegetation Complexes

Vegetation Complex	Description
Forrestfield Complex	Open forest and fringing woodland
Guildford Complex	Structure open forest to tall

3.0 Legislative Framework

3.1 Overview

Table 3 summarises the key legislation governing the protection and management of Western Australia's conservation significant species and communities, which are further discussed below.

Table 3 Relevant legislation, regulations and guidance

Legislation	Purpose
Commonwealth of Australia	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity.
EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species.	To assist in determining whether an action needs to be referred to the Australian Government. Also provides guidance on black cockatoo survey methodology.
EPBC Act Draft Referral Guidelines, 2017	These draft guidelines are intended to assist proponents in determining whether an action needs to be referred to the Australian Government. Definitions of habitat are provided as are criteria used to judge significant impact for these black cockatoo species.
Western Australia	
Biodiversity Conservation Act 2016 (BC Act)	Provides for the conservation and protection of Western Australia's biodiversity and biodiversity components.
Environmental Protection Act 1986 (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
EPA Technical Guidance – Terrestrial Fauna Surveys, 2016	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial fauna.
EPA Technical Guidance – Flora and vegetation Surveys for Environmental Impact Assessment, 2016	Provides guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in EIA.

3.2 *Environment Protection and Biodiversity Conservation Act 1999*

3.2.1 Matters of National Environmental Significance

Matters of national environmental significance include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

3.2.2 Flora and fauna

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 4, with an additional category for other specially protected fauna.

Table 4 Categories of species listed under Schedule 179 of the EPBC Act

Code	Conservation Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent

3.2.3 Vegetation Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 5.

Table 5 Categories of TECs that are listed under the EPBC Act

Code	Conservation Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

3.3 Western Australian Legislation

3.3.1 Flora and Fauna

Under the BC Act, flora and fauna can be listed as Threatened (T) or extinct (X). Threatened flora are plants which have been assessed as being at risk of extinction (DBCA, 2019). The Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection (WAH, 1998-).

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the BC Act. These categories are defined in Table 6.

Table 6 Conservation codes for flora and fauna listed under the *Biodiversity Conservation Act 2016* (DBCA 2019)

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

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to Priority Lists under Priorities 1, 2 or 3 by the State Minister for Environment. 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. Categories and definitions of Priority Flora and Fauna species are provided in Table 7.

Table 7 Conservation codes for WA flora and fauna listed by DBCA and endorsed by the Minister for Environment

Code	Conservation Category
P1	**Priority One – 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.
P2	**Priority Two – 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.
P3	**Priority Three – 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.
P4	**Priority Four – 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. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

3.3.2 Vegetation Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both State and Commonwealth legislation.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. Categories of TECs are defined in Table 8.

Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 9.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

There is currently no formal protection afforded to TECs or PECs listed at the state level.

Table 8 Conservation codes for State listed ecological communities

Conservation Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 9 Conservation categories for Priority Ecological Communities

Code	Conservation Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	Priority Four: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	Priority Five: conservation dependent ecological communities

3.3.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the BAM Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.

Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:

- C1 Exclusion - Organisms which should be excluded from part or all of Western Australia.
- C2 Eradication - Organisms which should be eradicated from part or all of Western Australia.
- C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

3.3.4 *Environmental Protection Act 1986* (and Clearing Regulations)

Section 38 (Part IV) of the EP Act provides that any person may refer a significant proposal (one that is likely to have a significant effect on the environment) to the EPA. The EP Act also states that where the environmental impact of a proposal can be adequately assessed and managed through other legislative mechanisms the proposal is unlikely to require formal environmental impact assessment.

If a proposal is not formally assessed by the EPA under Part IV of the EP Act, a Part V native Vegetation Clearing Permit may be required. Under Section 51C of the EP Act, clearing of native vegetation without a Native Vegetation Clearing Permit is an offence unless an exemption applies. Exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within Environmentally Sensitive Areas (ESA).

4.0 Methodology

The surveys included a desktop assessment, field survey, and a reporting component.

4.1 Desktop Assessment

The desktop assessment involved gathering background information for the local area. Desktop database searches were requested from the following government databases (including a 10 km buffer from the survey area boundary):

- DBCA threatened and priority flora, fauna and community's database
- WA Herbarium (WAH) records
- Atlas of Living Australia (AoLA)
- NatureMap
- EPBC Act Protected Matters search.

All flora, fauna and communities of conservation significance identified in the desktop assessment were assessed for their likelihood of occurrence within the survey area *(*Table 10*).* Available literature was consulted to describe the existing environment and define broad vegetation types. References included Beard (1979) vegetation mapping, the Biodiversity Audit of Western Australia (Mitchell et al., 2002), and Heddle *et al.* (1980) vegetation complex mapping.

Table 10 Categories of likelihood of occurrence for species and communities

Likelihood	Flora	Fauna	Communities
Likely to occur	Habitat is present in the Survey area and the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, habitat is present in the survey area and the species has been recorded in close proximity to the survey area.	Known occurrences of the community in close proximity to the survey area. Vegetation looks the same within the known occurrence and Survey area based on aerial imagery. Geographic location is similar to the survey area.
May occur	Habitat may be present and/or the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the survey area.	Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and Survey area based on aerial imagery. Geographic location is similar to the survey area.
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Survey area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Known occurrence of the community in close proximity to the survey area however geographic location does not occur in survey area.

4.2 Field Surveys

4.2.1 Flora and Vegetation

A detailed flora and vegetation assessment was undertaken on 8, 9, 16 and 19 November 2019 utilising methods outlined in the EPA (2016) Flora Survey Technical Guide. The assessment was completed by Floora de Wit (collection permit FB62000137). Floora de Wit has 13 years' experience undertaking flora and vegetation assessments. Floora completed a Bachelor of Science in Environmental Biology (Environmental Restoration) and completed a Postgraduate Diploma in Environmental Management and Impact Assessment.

The field survey was undertaken following completion of the desktop assessment. Information gathered during the desktop assessment informed the field survey sample design, intensity and survey timing. This ensured that the field survey was undertaken during ideal detection periods for environmentally significant features that were considered likely to occur in the survey area.

Floristic data was sampled from a combination of 11 quadrats and eight relevès. Non-permanent 10 x 10 m quadrats were defined by a measuring tape. Data collected from quadrats included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each sample point location was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- photograph
- soil details (type, colour, moisture)
- topography
- vegetation condition using the Keighery (1994) scale
- disturbance notes
- fire history
- species present
    - estimated height
    - estimated percentage cover.

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH.

4.2.2 Vegetation mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Quadrat data was analysed using cluster analysis to determine their floristic similarity and support vegetation community delineation. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework at level V Association (DotEE, 2017a).

Vegetation condition was determined using the Keighery (1994) condition scale (Table 11). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

Table 11 Bushland condition ratings (Keighery, 1994)

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

4.2.3 Floristic Community Type Analysis

The Keighery (2012) SCP dataset was used for the FCT analysis. The survey data was reconciled with this dataset and all species coded using the three first letters of the genus and species, reducing infra-specific names. All nomenclature of species followed the WA Plant Census.

The program PC Ord was used to undertake the Bray Curtis distance measure. The Bray Curtis dissimilarity measure was used to quantify the compositional dissimilarity between the quadrats based on presence absence data. Subtracting the results from 1 gives the similarity index, also known as the Bray Curtis index. This method is easily interpretable and provides meaningful results. A sense check was completed incorporating appropriate geology, soils, landscape and the description provided in the Gibson *et al.* (1994) reference material and Bush Forever (Government of WA, 2000).

The FCT analysis was used to inform the determination of TECs and PECs within the survey area.

4.2.4 Fauna

4.2.4.1 Level 1 Fauna Survey

A Level 1 fauna survey was conducted on 8, 9, 16 and 19 November by Ecologist Jared Leigh. The survey was conducted in accordance with Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b) and Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA, 2016c). Conducting the two surveys concurrently enabled consistent and clear mapping of the fauna habitats and vegetation communities.

The Level 1 fauna survey primarily focused on verifying the findings of the desktop study and identifying and mapping (significant) fauna habitat.

Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna, in order to determine the potential for these habitats to support conservation significant species. The fauna habitat assessments included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presence and abundance of key habitat features such as large mature trees, small and large hollows, fallen logs, course and fine litter, decorticating bark, bare ground, grass, stones and boulders, rock crevices, soil cracks, vines, dense shrubs, water bodies etc.
- Presence of fauna and secondary signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Connectivity of habitat.

In addition to recording all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings was documented. In particular, attention was given to conservation significant species identified in the desktop assessment as having the potential to occur in the area. All observations were made during daylight hours of 0700 and 1800.

The taxonomy and nomenclature of vertebrate species for mammals, reptiles and amphibians is consistent with the Western Australian Museum's Checklist of Vertebrates of Western Australia (2019) and for bird species the Bird's Australia Checklist of Australian Birds by Christidis and Boles (2008).

4.2.4.2 Targeted Black Cockatoo Survey

A targeted black cockatoo survey was conducted in conjunction with the Level 1 fauna survey and detailed flora and vegetation survey by Ecologists Jared Leigh, Laura Fisher and Cassandra House, and Botanist Floora de Wit.

The targeted black cockatoo survey was conducted to identify potential breeding, roosting and foraging habitat for the three threatened black cockatoo species that occur in WA, as all three species have the potential to utilise the habitats of the survey area. These are Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered under the EPBC Act and under the BC Act), Baudin's Cockatoo *Calyptorhynchus baudinii* (Endangered under the EPBC Act and under the BC Act) and the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable under the EPBC Act and under the BC Act). Refer to Section 5.2.2 for further information on these species. The survey was undertaken in accordance with the DSEWPaC (2012), also utilising the draft DotEE (2017) Referral Guidelines.

4.2.4.3 Breeding Habitat

The black cockatoo breeding habitat assessment focussed on quantifying breeding and potential breeding trees within the survey area. "Potential breeding trees" are generally considered to be hollow-forming eucalypt trees with a Diameter at Breast Height (DBH) >500 mm with "breeding trees" containing potentially suitable hollows. Details collected for each tree included:

- location
- tree species
- DBH
- number of potentially suitable hollows.
- hollow details – including dimensions, height from ground, direction, type of hollow, evidence of use etc.

4.2.4.4 Roosting Habitat

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). Potential roosting trees were searched for and assessed during the field survey.

4.2.4.5 Foraging Habitat

The quality of foraging habitat not only reflects the availability of food sources, but also the proximity to reliable water sources, connectivity to other suitable habitat, presence of breeding habitat, and proximity to confirmed roost and breeding sites (amongst others). These parameters were utilised by the DotEE (2017) to produce a draft quality of foraging habitat scoring system (Table 12). This scoring system was amended slightly to incorporate additional habitats and utilised to assess potential foraging habitat throughout the survey area.

Table 12 Foraging habitat quality scoring tool for the three Western Australian black Cockatoo species

	Carnaby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
10	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.
7	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* species (including *Dryandra* species) *Hakea* species and *Grevillea* species as well as eucalypt woodland and forest that contains foraging species. Does not include orchards, canola, or areas under RFA	Eucalyptus woodlands and forest of suitable foraging species and proteaceous woodland and heath, particularly Marri. Does not include orchards or areas under RFA	Jarrah and Marri woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies. Does not include areas under RFA.
5	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Introduced eucalypts as well as the introduced Cape lilac (*Melia acedarach*), and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant
1	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)
Additions: Context adjustor – attributes improving habitat quality			
+3	Is within the Swan Coastal Plain	Is within known foraging area	Jarrah and/or Marri shows good recruitment
+3	Contains trees with suitable nest hollows		
+2	Primarily comprises Marri	Primarily contains Marri	Primarily contains Marri and/or Jarrah

	Carnaby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
+2	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo)		
+1	Is used for roosting		
Subtractions: Context adjustor – attributes reducing habitat quality			
-2	No clear evidence of foraging debris		
-2	No other foraging habitat within 6 km		
-1	Is >12 km from known breeding location		
-1	Is >12 km from known roosting location		
-1	Is >2 km from watering point		
-1	Disease present (e.g. *Phytophthora cinnamomi* or Marri canker)		

Notes: Scoring tool sourced from DotEE (2017) and amended slightly by AECOM

5.0 Survey Limitations

No significant limitations were identified that may impact on the ability to use the data to inform the environmental impact assessment. Limitations of the ecological surveys are discussed in Table 13.

Table 13 Limitations of the Ecological Surveys

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Availability of contextual information on the region	**Nil** Sufficient resources for the Swan Coastal Plain were available to provide contextual information including Beard (1981), Heddle *et al*. (1980) vegetation mapping, Perth @ 3.5 million (Government of WA, 2015) and the Gibson *et al.* (1994), Keighery *et al.* (2012) swan coastal plain datasets.	**Nil** Sufficient contextual information is available for the Swan Coastal Plain and the survey area. Resources utilised to inform the targeted black cockatoo survey include the DBCA database, Birdlife (2018), DotEE (2019a), AoLA (2019) and DSEWPac (2012).	**Nil** Sufficient contextual information is available on the Swan Coastal Plain and the survey area. Resources utilised to inform the level 1 fauna survey include the DBCA database, AoLA (2019), Naturemap, EPBC Act PMST.
Competency/experience of consultant conducting survey	**Nil** The flora and vegetation assessment was led by Floora de Wit who has more than 13 years' experience conducting surveys of similar scope.	**Nil** Jared is an ecologist with over 16 years' experience in the environmental industry and has conducted targeted black cockatoo surveys consistently over the past three years.	**Nil** Jared is an ecologist with over 16 years' experience in the environmental industry and has conducted Level 1 fauna surveys in a range of bioregions within Western Australia.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Minor** The flora and vegetation was represented by 11 quadrats and 8 relevés. FCT analysis had low similarity across several quadrats (<30% similarity) which made it difficult to infer the FCT and therefore determine the conservation status of the vegetation. A second scoring event would likely improve this similarity. Instead, other factors including the DBCA TEC/PEC search results and contextual information was used to determine community significance.	**Nil** The objective of the survey is not necessarily to record black cockatoos within the survey area, but to map the habitat present. However, both Carnaby's Cockatoo and the Forest Red-tailed Black Cockatoo were recorded through either direct sightings or indirect (foraging) evidence. Foraging evidence can be searched for at any time of year, and can remain on the ground for up to two years. Tree hollow presence and suitability for utilisation by black cockatoos cannot always be assessed adequately at ground level, and hence the Precautionary Principle is utilised where appropriate.	**Minor** Information gained for a Level 1 fauna survey was sufficient. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1700hrs) and all habitats were assessed. Nocturnal species were predominantly observed through indirect evidence.
Completion (is further work needed)	**Nil** The objectives of the Flora and Vegetation Survey were met in that significant environmental values were able to be recorded and mapped to inform environmental constraints mapping and decision-making for negating environmental impacts.	**Minor to Moderate** Hollow presence and suitability cannot always be assessed adequately at ground level due to visibility, safety concerns and / or private property access issues, and hence the Precautionary Principle should be utilised where appropriate. These hollows could be assessed further by utilising elevated work platforms (EWPs), specialist tree climbers, pole cameras and / or drones, however this is probably not required at this stage and the objectives of the targeted black cockatoo survey were met.	**Nil** The objectives of the level 1 fauna survey were met for the areas surveyed, and no further work is required.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Remoteness and/or access problems	**Nil** All areas of native vegetation were accessible on foot.	**Minor** A private property directly adjacent the rail-line could not be accessed for the survey. This was left out of the mapping where appropriate. Restricted access to several other private properties limited the assessment of several potential black cockatoo trees. The objectives of the targeted black cockatoo survey were met.	**Minor** A private property directly adjacent the rail-line could not be accessed for the survey. This was left out of the mapping where appropriate. The objectives of the Level 1 fauna survey were met.
Timing, weather, season, cycle	**Nil** Rainfall was below average in September, however near-average rainfall was experienced in the winter months.	**Nil** No limitations were identified relating to timing, weather, season or cycle. Foraging evidence can be searched for at any time of year and can remain on the ground for up to two years (DotEE, 2017).	**Minor** The survey was conducted during a period of reasonable weather in Spring. Although it was limited to one survey period during one year, and predominantly during daylight hours, this does not significantly impact a Level 1 fauna survey.
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	**Nil** The botanical survey was not disrupted or impacted.	**Nil** The targeted black cockatoo survey was not disrupted or impacted.	**Nil** The Level 1 fauna survey was not disrupted or impacted.

6.0 Desktop Assessment Results

6.1 Threatened and Priority Ecological Communities

The desktop assessment identified 13 TECs and PECs that may occur in the survey area, this includes five communities listed under the EPBC Act, nine listed under the BC Act, and four listed as PECs listed by DBCA. The descriptions and relationships of TECs and PECs are presented in Table 14.

Six TECs are known to occur within the survey area or occur in close proximity with their buffer overlapping with the survey area. These TECs include:

- *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (FTC3a) occurs in Brickwood Reserve and is known to occur in the rail corridor
- *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (FCT3b) known to occur in the rail corridor
- *Corymbia calophylla - Xanthorrhoea preissii woodlands* and shrublands, Swan Coastal Plain (FCT3c) known from Brickwood Reserve
- Dense shrublands on clay flats (FCT09) is associated with the wetland in Brickwood Reserve and is likely to extend into the survey area
- Banksia dominated woodlands of the SCP is known from 285 locations including Brickwood Reserve and Lambert Lane Bushland
- Low lying *Banksia attenuata* woodlands or shrublands (FCT21c) is known to occur in Brickwood Reserve.

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Table 14 TECs and PECs descriptions and their likelihood of occurrence

Community Name and Description	State Listing	EPBC Listing	Likelihood
Eucalyptus marginata woodlands on Whicher foothills (FCT1a)	P3		Unlikely
This PEC occurs along the northern edge of State Forest along the base of the Whicher Range and is composed of *Eucalyptus haematoxylon*, *Corymbia calophylla, Eucalyptus marginata* forests and woodlands. Taxa virtually restricted to the type include *Acacia varia* subsp*. varia, Agonis grandiflora* and *Xanthosia pusilla*.			
Southern wet shrublands (FCT02)	EN		Unlikely
Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain (FTC3a)	CR	E	Known
The floristic composition of these communities varies with water regime, with FCT3a on heavy soils occurring on the wettest of the sites and being associated with the median species richness, and lowest level of weed invasion and disturbance (DotEE, 2017c). Groundwater is generally within 3m of the natural ground surface in occurrences of this community, and this indicates that these wetlands have a high level of dependence on groundwater (DotEE, 2017c).			
Corymbia calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain (FCT3b)	VU		Known
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (FCT3c)	CR	E	Known
Occurs on heavy soils of eastern side of SCP. Critical habitat includes the heavy soils on which is occurs, fresh superficial groundwater and/or surface water, and the catchment for this water. This community represents the dry type of *C. calophylla* community, related to FCT3a and FCT3b (DotEE, 2017d).			
Clay Pans of the Swan Coastal Plain			
This TEC occurs where clay soils form an impermeable layer close to the surface where wetlands form that rely solely on rainfall to fill in winter and dry in summer (DSEWPaC, 2012b). The community is a shrubland (sometimes a low open woodland) over geophytes, herbs and sedges in the wetter parts of the site. The TEC is associated with several Ramsar sites including Brixton Street Wetlands, Ellen Brook Swamps System and Forrestdale Lake Nature Reserve. The identification of this TEC relies on FCT analysis and a consideration of characteristics unique to this TEC including hydrological functions. Associated State-listed TECs include:			
• Herb rich shrublands in clay pans (FCT08)	VU	CE	Unlikely
• Dense shrublands on clay flats (FCT09)	VU	CE	Likely/known
• Shrublands on dry clay flats (FCT10a)	EN	CE	Unlikely

Community Name and Description	State Listing	EPBC Listing	Likelihood
Banksia Woodlands of the Swan Coastal Plain			
The Banksia Woodlands TEC (TSSC, 2017) incorporates woodland of *Banksia* species with scattered Eucalypts and other tree species over a species rich mix of sclerophyllous shrubs, graminoids, and forbs. The community shows high endemism and considerable local variation in species composition across its range. It occurs mainly on deep Bassendean and Spearwood sands or occasionally on Quindalup sands. The TEC is identified using the key diagnostic features, condition thresholds and consideration of other environmental factors as described in the approved conservation advice. The community is associated with several State-listed TECs and PECs. Those relevant for the BRE include:			
• *Banksia* Dominated Woodlands of the Swan Coastal Plain IBRA Region	P3	E	Known
• Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands (FCT20b)	EN	E	Known
• Low lying *Banksia attenuata* woodlands or shrublands (FCT21c)	P3	E	Unlikely
Casuarina obesa association	P1		Unlikely
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	EN	E	Unlikely
This TEC occurs on the heavy soils of the eastern side of the Swan Coastal Plain. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands, and *Melaueca brevifolia, M. systena, or M. viminea* shrublands have been recorded on Muchea Limestone. The TEC is known to occur within the Canning, Chittering, Gingin, Gosnells, Harvey, and Swan Local Government Areas.			

6.2 Conservation Significant Flora

The desktop study identified 83 Threatened and Priority flora species that may occur in the survey area. This includes 27 species listed under the EPBC Act and the BC Act and 56 species listed as Priority flora by DBCA.

The considerable number of conservation significant species identified is reflective of the proximity of the survey area to several patches of remnant vegetation including Ellis Nature Reserve, Lambert Lane Bushland, Cardup Nature Reserve, Norman Road Bushland, and Lowlands Road Bushland. Furthermore, the Darling Scarp is 600m east of the survey area with unique granite outcrop and heathland habitat which is favoured by 23 of the 82 species identified.

The likelihood assessment was conducted which determined that six flora species are likely to occur within the corridor (Table 15). Two of these are listed as Threatened under the EPBC Act and BC Act. Another 20 species 'may occur' and 56 species are 'unlikely to occur'.

The desktop results are mapped in Figure 3. A comprehensive species list of the desktop flora results is presented in Appendix A and includes justification for the likelihood assessment.

Table 15 Flora species determined as likely to occur

Taxon	Cons. Status		Habitat
	EPBC	WA	
Drosera occidentalis		P4	Recorded in vicinity on damp flats of grey sandy clays.
Johnsonia pubescens subsp. *cygnorum*		P2	Species occurs on grey, white and yellow sands, typically on flat terrain and seasonally wet sites.
Schoenus pennisetis		P3	Species grows on grey or peaty sand to sandy clays, associated with swamps and winter-wet depressions. Known from Brickwood Reserve.
Synaphea sp. Serpentine (G.R. Brand 103)	CE	CR	Flat terrain on grey-brown sandy loams to clay in seasonally wet areas.
Tetraria australiensis	V	VU	Records in vicinity are from low plains, slopes and low dunes with white/grey sand, yellow/grey sand and brown/yellow sands in Eucalypt woodlands.
Verticordia lindleyi subsp. *lindleyi*		P4	Grows in white to grey and yellow sand, often with or over clay and gravel, usually low-lying and winter-wet. Frequently in heath, shrubland and open woodland

6.3 Conservation Significant Fauna

The NatureMap search identified 397 fauna species that have been recorded within the survey and surrounding area. Many marine and coastal species were captured in this search due to the proximity of the survey area to the coast and the 12 km buffer used.

The desktop fauna assessment identified 71 conservation significant fauna species that could potentially occur within the survey area. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the survey area and reviewing the recent records and distribution of the species. This assessment determined that:

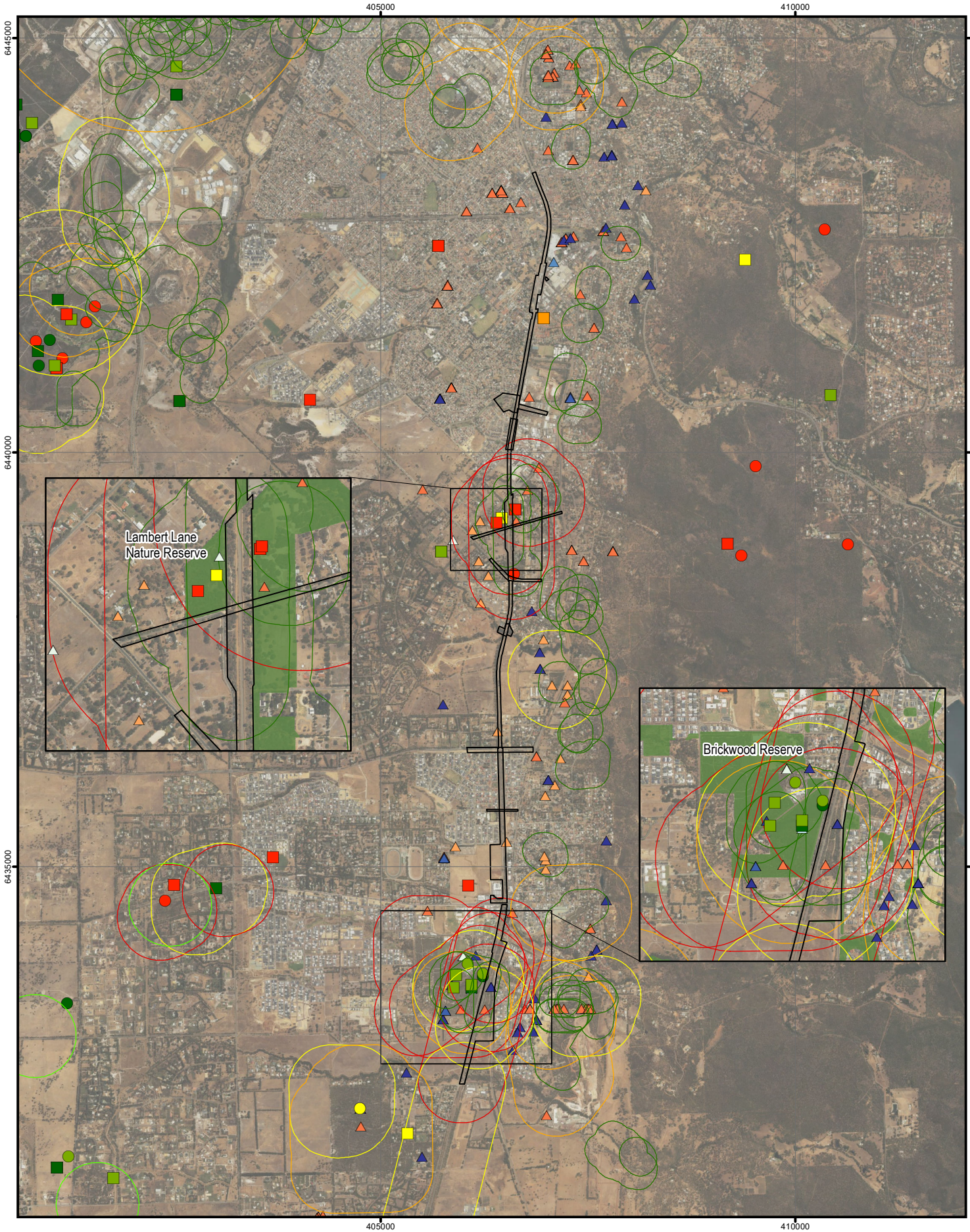
- four species are ‘likely to occur’
- six species ‘may occur’
- 61 species are ‘unlikely to occur’.

The ten species considered as ‘likely to occur’ and “may occur” in the survey area include four bird, four mammal and two invertebrate species. Table 16 identifies these species and provides relevant ecological information. The conservation significant categories as defined by DBCA, the BC Act and the EPBC Act are defined in Section 3. The full desktop assessment for all fauna species and their likelihood of occurrence in the survey area are presented in Appendix A.

Table 16 Conservation Significant Fauna Species that are Likely to and May Occur in the Survey Area

Scientific Name	Common Name	Conservation Status		Ecology
		EPBC	WA	
Birds				
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	V	VU	The Forest Red-tailed Black Cockatoo is 55-60 cm in length and mostly glossy black with a pair of black central tail feathers, a crest, robust bill and bright red, orange or yellow barring in the tail (Higgins, 1999). Males are distinguished by broad red tail panels that are only visible when taking off or alighting (Higgins 1999). Requires tree hollows to nest and breed, occurs in forests of Karri *Eucalyptus diversicolor*, Jarrah *E. marginata* and Marri *Corymbia calophylla*, with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone *et al.*, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.
Calyptorhynchus baudinii	Baudin's Cockatoo	E	EN	Baudin's Cockatoo is a large cockatoo that measures 50–57 cm in length, with a wingspan of approximately 110 cm. Mostly dull black in colour, with pale whitish margins on the feathers (Higgins, 1999). Habitat critical to the survival of this species includes forests of Karri *Eucalyptus diversicolor*, Jarrah *E. marginata* and Marri *Corymbia calophylla*, in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone et al., 2010). Breeding has been recorded to the south-west of the area bounded by Leschenault, Collie and Albany (DSEWPaC, 2012), with the most northerly record at Lowden, near Donnybrook (Johnstone & Storr, 1998). Breeding has also been recorded at Serpentine (hills area), and east to Kojonup and near Albany (Johnstone & Kirkby, 2008).
Calyptorhynchus latirostris	Carnaby's Cockatoo	E	EN	Carnaby's Cockatoo is a white-tailed black cockatoo endemic to the south-west of Western Australia. It is a postnuptial nomad and typically moves west soon after breeding. Breeding occurs mainly from early July to mid-December. There has been an apparent shift in its breeding range further west and south since the middle of last century (Johnstone *et al*., 2010). The species nests in hollows in eucalypts, particularly Salmon Gum *Eucalyptus salmonophloia* and Wandoo *E. Wandoo*, but nests have been found in other eucalypts including York Gum *E. loxophleba*, Flooded Gum *E. rudis,* Tuart *E. gomphocephala* and Marri *Corymbia calophylla* (Johnstone *et al*., 2010). 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 (Johnstone *et al*., 2010). Diet consists of an array of Proteaceous and *Eucalyptus* species. Foraging habitat, including *Banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al*., 2010).

Scientific Name	Common Name	Conservation Status		Ecology
		EPBC	WA	
Falco peregrinus	Peregrine Falcon		-OS	The Peregrine Falcon is a medium-sized raptor (length 35-55cm; wingspan 80-105cm) with slate-grey back, a striking charcoal black head and face which contrast with a pale cream bib on the neck and breast (Birdlife Australia, 2018). A well-known falcon, the Peregrine inhabits a vast array of environs in Australia. Usually uncommon and migratory (Pizzey & Knight, 2007). This species lays its eggs in recesses of cliff faces, tree hollows or large abandoned nests (Bamford, 2009)
Mammals				
Dasyurus geoffroii	Chuditch	V	VU	At maturity the Chuditch is the size of a small domestic cat with white spotted brown pelage, large rounded ears, pointed muzzle, large dark eyes and non-hopping gait. Following European settlement, the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The Chuditch requires adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive.
Isoodon fusciventer	Quenda	-	P4	The Quenda or Southern Brown Bandicoot exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).
Hydromys chrysogaster	Water-rat	-	P4	The Water Rat is one of the few Australian mammals adapted to the aquatic environment. It has a streamlined body and broad, partially webbed hind feet. The species occurs in the vicinity of permanent bodies of fresh or brackish water. Dens are made at the end of tunnels in banks and occasionally in logs (Van Dyck & Strahan, 2008).
Phascogale tapoatafa wambenger	Brush-tailed Phascogale	-	CD	The Brush-tailed Phascogale is one of the most arboreal dasyurids and rarely feeds on the ground. The species is distinguished by a large black tail. The species formerly occupied all the dry sclerophyll forests and woodlands of temperate and tropical Australia. The species suffered a drastic reduction in habitat due to clearing of prime habitat for agriculture and now prefers open forest with sparse groundcover. It has been observed in habitats ranging from mallee to rainforest.
Invertebrates				
Euoplos inornatus	Inornate Trapdoor Spider	-	P3	*Euoplos* is a spider genus in the family Idiopidae which is found in various geographical locations in Australia. The trapdoor spider species *Euoplos inornatus* occurs on the eastern edge of the SCP, although most records are from the Darling Scarp and the Jarrah forest to the east (Invertebrate Solutions, 2018).
Westralunio carteri	Carter's Freshwater Mussel	V	VU	The only reasonably large bivalve in freshwaters of south-west Western Australia. Occurs in greatest abundance in slower flowing waters with stable sediments that are soft enough for burrowing. Salinity tolerance is quite low (>3 g /L is lethal) (Klunzinger *et al.,* 2012).



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DATUM GDA 1994 MGA Zone 50
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Kilometres

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

Survey Area

TEC / PEC
- Critically Endangered
- Endangered
- Vulnerable
- Priority 1
- Priority 3

WA Herb
- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

Threatened and Priority Flora Database
- Threatened
- Priority 2
- Priority 3
- Priority 4

Desktop Threatened Fauna
- Endangered
- Vulnerable
- Conservation Dependant
- Specially Protected
- International Agreement
- Priority 2
- Priority 3
- Priority 4

Desktop Results for Flora, Fauna and Communities

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure 3

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig3_DesktopFloraFauna_A4P_v1.mxd (WyattK2)

A4 size

7.0 Field Survey Results

7.1 Vegetation

7.1.1 Floristic Community Type Analysis

The FCT assessment was completed for 11 quadrats completed in the survey area. The inferred FCT relied upon the outcome of the data analysis (using Keighery *et al*. 2012 SCP dataset), consideration of key species as defined in Gibson *et al.* (1994), landform, soils and Bush Forever (Govt. of WA, 2000) descriptions.

The assessment identified four FCTs of which three are listed as TECs under the EPBC Act and BC Act:

- FCT3a *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (EPBC Endangered WA Critically Endangered)
- FCT3c *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (EPBC Endangered, WA Critically Endangered)
- FCT6 Weed dominated wetlands on heavy soils
- FCT8 Herb rich shrublands in claypans (EPBC Critically Endangered, WA Vulnerable).

Low similarity for four quadrats led to inability to infer FCT for these quadrats. The low similarity may reflect location of quadrat (i.e. ecotone, disturbed areas), time spent assessing quadrat (i.e. survey effort), and time of year.

The inferred FCT for each quadrat and justification for this conclusion is presented in Table 17.

Table 17 Inferred FCT for Byford quadrats

Quadrat	Similarity	FCT	SCP Quadrat	Inferred FCT
Q02	35%	3c	DUCK-1	FCT3c *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands is a good fit.
	33%	3c	WATER-3	
	31%	3c	DUCK-2	
Q03	26%	3c	yarl01	Low similarity, difficult to infer with confidence. Includes overstorey of *C. calophylla* over *Kingia australis* and *Xanthorrhoea preissii* therefore could be FCT3c or FCT3a. No obvious reason why similarity would be low except that the quadrat is located between cleared paddocks, tracks, road and rail and adjacent to altered drainage/wetland associated with the bank of the rail.
	25%	3c	DUCK-1 WATER-3	
	25%	25	much04	
Q04	36%	3a	brick6	FCT3a *Corymbia calophylla - Kingia australis* woodlands on heavy soils is the best fit. *Kingia* spp. occurs sporadically in the vicinity, recorded as opportunistic.
	36%	3b	card13	
	34%	3a	lamb2 MUD-5	
Q05	30%	3a	MUD-4	Low similarity/mixed results. Represents wetland adjacent to FCT3a. Description matches FCT6 Weed dominated wetlands on heavy soils with 20% weed cover and is situated on heavy soils typical of the area. Low similarity may reflect the altered hydrology, survey effort and/or survey timing. As a wetland, a scoring event during wetter months would identify more species.
	29%	3a	brick5	
	29%	6	card10	
	29%	4	cas04	

Quadrat	Similarity	FCT	SCP Quadrat	Inferred FCT
Q06	26%	3b	serp02	Low similarity, unable to infer FCT with confidence. Quadrat in wetland adjacent to FCT3a/3b which explains similarity to these. FCT8 was considered however no known records of this TEC nearby and does not include "typical" species of FCT8. Low similarity may reflect the altered hydrology, survey effort and/or survey timing. As a wetland, a scoring event during wetter months would identify more species.
	26%	8	WATER-4	
	25%	3a	brick3	
Q07	25%	4	gosn07	Low similarity, unable to infer FCT with confidence. Vegetation a mix of wetland and woodland influence on gravel to clay soils. FCT4 is not correct (incorrect landform and description). Low similarity may be influenced by quadrat location (ecotone potentially), historical disturbance, or survey effort (single scoring event, time of year, time spent searching).
	24%	4	FL-1	
Q10	46%	3a	brick6	FCT3a and FCT3c were both considered. A review of typical and common species determined that FCT3a is more appropriate despite the absence of *Kingia australis*. Furthermore, the proximity of this quadrat to a wetland, therefore likely to be low-lying, insinuates potential higher dependence on groundwater which fits with FCT3a.
	40%	3a	brick5	
Q13	35%	20a	activ03	Includes *C. calophylla, Kingia australis* and *Xanthorrhoea preissii* as dominant. High species richness, near low-lying area which is representative of FCT3a. No *Banksia* spp. (FCT20a) and not correct location for FCT2.
	34%	3a	brick6	
	34%	2	SF1201	
	34%	3b	card13 waro 02	
Q15	22%	8	MUD-7	Low similarity, unable to infer FCT with confidence. Represents ecotone of FCT3a and wetland. FCT8 not mapped at this location and none of the "typical" species present. Considered FCT9 due to close proximity to known occurrence, however no "typical" species present either. Applied precautionary principles and suggested it may represent FCT8 Herb rich shrublands in claypans. Low similarity may reflect the survey timing, as a wetland a scoring event during wet months may be beneficial.
	21%	8	BRIX-1	
Q15b	45%	3b	serp04	FCT3b *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils is a good fit. Includes *Kingia australis* and would assume similar FCT to Q16 in vicinity. On the vegetation map the precautionary principle was applied and assumed to represent the EPBC listed TEC FCT3a.
	41%	3b	BURND02, card13	
	40%	3b	card12	
Q16	44%	3a	lamb2	FCT3a *Corymbia calophylla - Kingia australis* woodlands on heavy soils is a good fit, close to adjacent wetland and includes *Kingia australis* and is at known location of this FCT.
	37%	3b	Serp04	
	34%	3b	Card13, Norm04	

7.1.2 Threatened and Priority Ecological Communities

Three TECs listed under the EPBC Act and BC Act have been identified as occurring in the survey area. The identification of these TECs is supported by the FCT analysis (see Section 7.1.1) and desktop study results.

Where a quadrat was identified as representing a TEC/PEC in the FCT assessment, aerial imagery, condition observations, and interpretation of these was used to define the boundaries of this TEC. This boundary was not necessarily aligned with the vegetation community mapping boundary.

The TECs and their extent is presented in Table 18 and mapped in Figure 4.1 to 4.12.

Table 18 Threatened Ecological Communities

TEC Name	Cons Status		Quadrats	Associated Community	Extent (ha)
	EPBC	WA			
Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain (SCP3a)	E	CR	Q04, Q10, Q13, Q16 Q03 low confidence	CcXpTo, CcAhMt	6.68
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands (SCP3c)	E	CR	Q02 (Q03 low confidence)	CcXpTo	0.18
FCT8 Herb rich shrublands in claypans	CE	VU	Q06 and Q15 at low confidence	HtNa, PeCaBs	1.57

Three other TECs were determined as likely/known to occur. That is, their buffer overlaps significantly with the survey area. These are discussed briefly below.

Dense shrublands on clay flats (FCT09) is known to occur in Brickwood Reserve, adjacent to the survey area. This TEC may be present, represented by vegetation HtNa and PeCaBs. However, the FCT assessment determined that quadrats were more representative of FCT8 as mentioned above. At the Commonwealth level, both FCT8 and FCT9 come under the “Claypans of the Swan Coastal Plain TEC” and both are listed as Vulnerable under the BC Act. This wetland vegetation is therefore still captured as conservation significant.

Banksia Woodlands on the Swan Coastal Plain, including two State TECs “*Banksia* dominated woodlands of the SCP” and ”Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands” were considered known to occur. There are known locations at Brickwood Reserve and Lambert Lane Reserve. No Banksia overstorey was observed in the survey area, and neither of these FCTs were identified in the FCT assessment. Mapping of Banksia woodlands in the metro area is based on Commonwealth’s “likely to occur” area and represents broad-scale mapping units. As such, their locations are not always representative of on-ground conditions.

7.1.3 Vegetation Communities

A total of 11 vegetation communities were described and mapped from 11 quadrates and eight relevés within the survey area during the field assessment in November 2019. This includes:

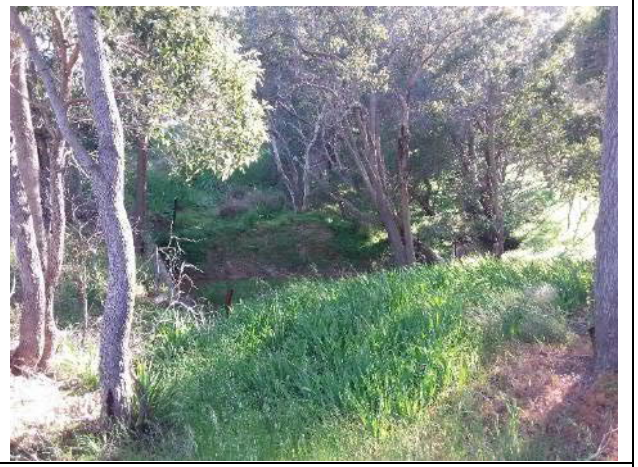
- five Woodlands: Marri
- one Woodlands: Mixed
- two Shrublands: Mixed
- three significantly modified vegetation types (planted, trees and cleared).

All community descriptions, significance and additional details are presented in Table 19 and mapped in Figure 4.1 to 4.12.

Table 19 Vegetation community details

Description	Additional Detail	Photograph
AfVaLm Woodland: Marri and *Allocasuarina* *Allocasuarina fraseriana* and *Corymbia calophylla* mid open woodland over *Verticordia acerosa* var. *preissii*, *Hakea trifurcata* and *Acacia pulchella* var. *glaberrima* mid shrubland over *Lomandra micrantha, Stylidium dichotomum* and *Conostylis aculeata* subsp. *preissii* low forbland. R08 is located on graded/rehabilitated area.	Survey effort: Q07, R08 Extent: 1.54 ha Species richness: 52 native and 4 weed species	
AfXpEc Woodland: Mixed *Allocasuarina fraseriana* and **Eucalyptus* spp. (planted) mid open woodland over *Xanthorrhoea preissii* and **Acacia* spp. (planted) tall shrubland over **Ehrharta calycina, *Eragrostis curvula* and **Avena barbata* tall grassland.	Survey effort: R11, R12, R19 Extent: 0.44 ha Species richness: 4 native and 8 weed species	

Description	Additional Detail	Photograph
CcAhMt Woodland: Marri *Corymbia calophylla, Eucalyptus lane-poolei* and *Nuytsia floribunda* mid open woodland over *Allocasuarina humilis, Xanthorrhoea preissii* and *Hibbertia hypericoides* mid shrubland over *Mesomelaena tetragona*, *Tetraria octandra* and *Schoenus clandestinus* low sedgeland. Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered)	Survey effort: Q15b, Q16 Extent: 1.96 ha Species richness: 59 native and 5 weed species	
CcHtCa Woodland: Marri *Corymbia calophylla* mid woodland over *Hakea trifurcata, Kunzea micrantha* and *Viminaria juncea* tall shrubland over *Mesomelaena tetragona, Cyathochaeta avenacea* and *Lepidosperma leptostachyum* mid sedgeland with *Conostylis aculeata* subsp. *preissii, *Watsonia meriana* and *Synaphea petiolaris* subsp. *petiolaris* low forbland Represents wetland vegetation and/or ecotone of wetland and modified drainage and Marri Woodlands on uplands. Likely to be a Groundwater Dependent Ecosystem (GDE).	Survey effort: R09 Extent: 3.22 ha Species richness: 13 native and 3 weed species	

Description	Additional Detail	Photograph
CcWmEc Woodland: Marri *Corymbia calophylla* mid woodland over **Watsonia meriana, *Oxalis pes-caprae* and **Fumaria capreolata* mid to low forbland with **Ehrharta calycina* and **Avena barbata* tall grassland. Represents degraded riparian vegetation associated with minor drainage. Likely to be a GDE.	Survey effort: R01 Extent: 0.22 ha Species richness: 4 native and 5 weed species	
CcXpTo Woodland: Marri *Corymbia calophylla* mid woodland over *Xanthorrhoea preissii, Stirlingia latifolia* and *Kingia australis* mid tall shrubland with *Tetraria octandra, Mesomelaena tetragona* and *Cyathochaeta avenacea* tall sedgeland. Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered) One area was mapped as an ecotone of PeCaBs/CcXpTo with the area supporting qualities of both communities.	Survey effort: Q02, Q03, Q04, Q10, Q13, R17, R18 Extent: 8.09 ha (+0.44 ecotone) Species richness: 95 native and 12 weed species	

Description	Additional Detail	Photograph
HtNa Shrubland: Mixed *Hakea trifurcata, Xanthorrhoea preissii* and *Verticordia acerosa* var. *preissii* tall to mid shrubland over *Neurachne alopecuroidea, Chamaescilla corymbosa* and *Haemodorum simplex* mixed grass and forbland. Represented riparian vegetation that is higher in landscape than PeCaBs. Soils include clays and gravel. As riparian vegetation this community provides important roles and functions in the local area and should be considered locally significant. Likely to be a GDE.	Survey effort: R14, Q15, R19 Extent: 1.47 ha Species richness: 40 native and 9 weed species	
PeCaBs Shrubland: Mixed *Pericalymma ellipticum, Xanthorrhoea acanthostachya* and *Hakea varia* mid shrubland over *Chaetanthus aristatus* and *Hypolaena exsulca* tall rushland over *Borya ?scirpoidea, Schoenus efoliatus* and *Tricostularia neesii* low mixed herb and sedgeland. Likely to represent Claypans of the Swan Coastal Plain (EPBC Critically Endangered) and may represent WA TEC Herb rich shrublands in claypans (FCT8). Likely to be a GDE.	Survey effort: Q05, Q06 Extent: 1.12 ha (+0.44 ecotone) Species richness: 48 native and 11 weed species	

Description	Additional Detail	Photograph
Significantly modified vegetation including: - **Trees** comprising native and introduced trees - **Planted** comprising non-native garden plants/grassland - **Cleared** comprising mostly grassland/weeds - **Hardstand** comprising paved areas	Extent: 77.46 ha	

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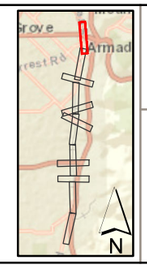

Vegetation Communities, Vegetation Condition and Fauna Habitats

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Figure

4.1

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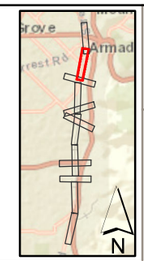

Vegetation Communities, Vegetation Condition and Fauna Habitats

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Figure 4.2

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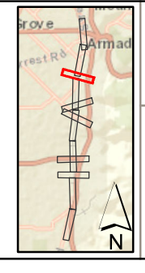

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Figure 4.3

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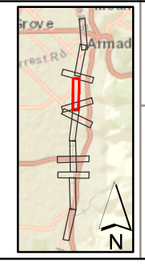

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Figure 4.4

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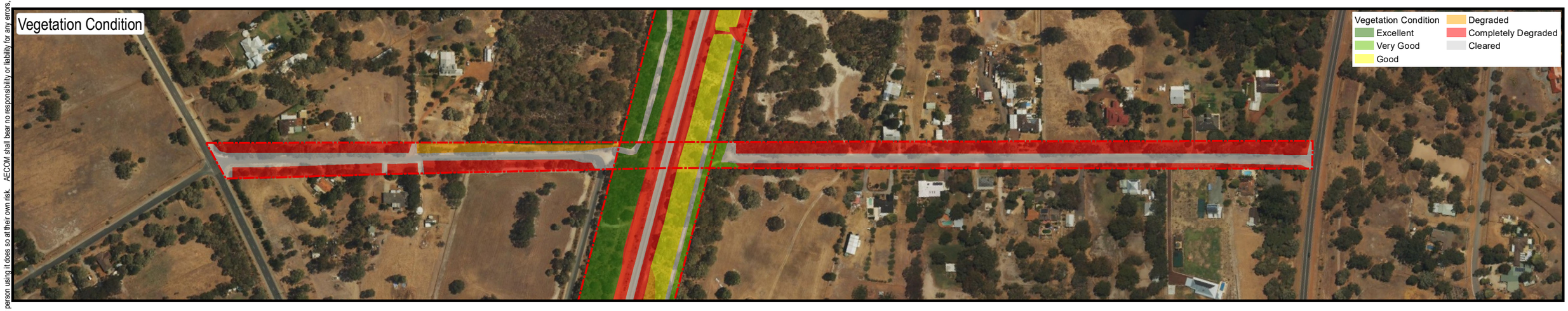
Vegetation Communities

Vegetation Condition



Fauna Habitats

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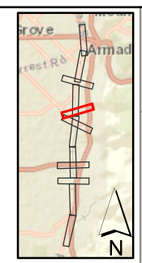

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Figure 4.5

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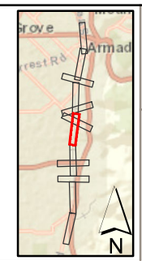

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Figure

4.6

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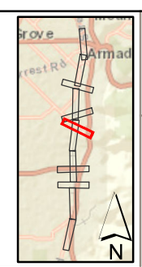

Vegetation Communities, Vegetation Condition and Fauna Habitats

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Figure 4.7

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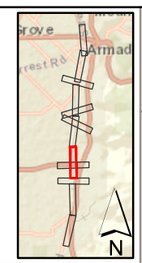

Vegetation Communities, Vegetation Condition and Fauna Habitats

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BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure
4.8

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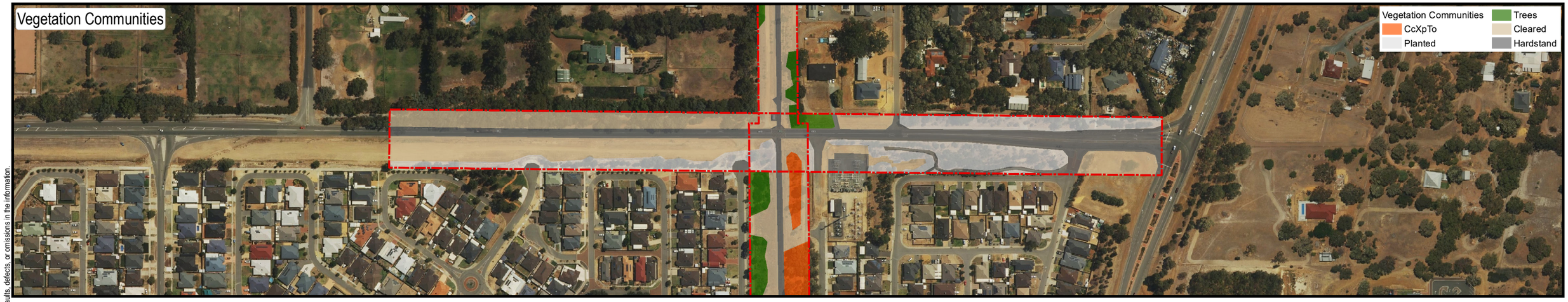

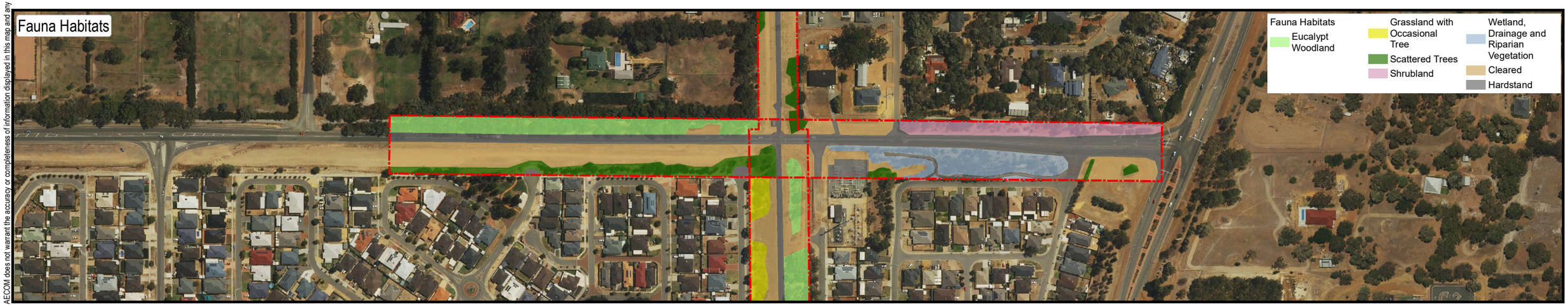

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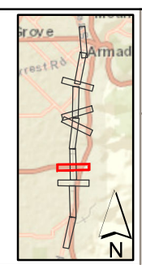

Vegetation Communities, Vegetation Condition and Fauna Habitats

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BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure

4.9

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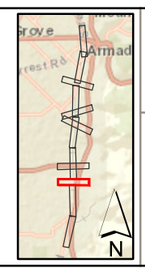
Survey Area



Vegetation Communities, Vegetation Condition and Fauna Habitats

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure

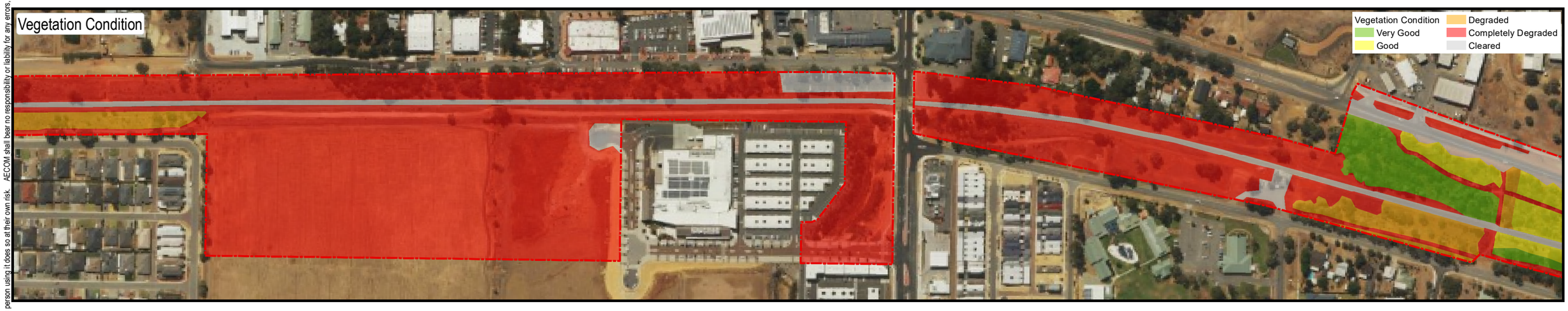
4.10

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig4_VegCommCondHab_A3L_v3.mxd (WyattK2)

A3 size

Vegetation Communities

Vegetation Condition



Fauna Habitats

PROJECT ID	60615333
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	18 JUN 2020

AECOM
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1:4,000 (when printed at A3)

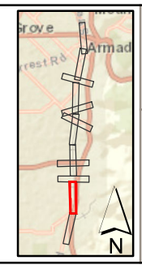
DATUM GDA 1994 MGA Zone 50

0 50 100
metres

Data sources:

Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010); Geoscience Australia; Streetpro

Survey Area



Vegetation Communities, Vegetation Condition and Fauna Habitats

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure 4.11

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig4_VegCommCondHab_A3L_v3.mxd (WyattK2)

A3 size

Vegetation Communities

Vegetation Condition

Fauna Habitats

PROJECT ID	60615333
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	18 JUN 2020

AECOM

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1:4,000 (when printed at A3)

DATUM GDA 1994 MGA Zone 50

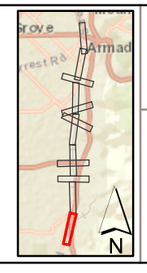
0 50 100

metres

Data sources:

Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010); Geoscience Australia; Streetpro

Survey Area



Vegetation Communities, Vegetation Condition and Fauna Habitats

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure 4.12

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig4_VegCommCondHab_A3L_v3.mxd (WyattK2)

A3 size

7.1.4 Vegetation Condition

Vegetation condition varied between Excellent and Completely Degraded. The majority of remnant native vegetation was in Good or better condition. These areas were generally part of larger patches that extended beyond the survey area.

Degradation was caused by clearing, weed invasion, rubbish, altered hydrology from rail/roads and development. Vegetation condition is mapped in Figure 4.1 to 4.12 and extent detailed in Table 20.

One part of the survey area was not accessed (discussed in 5.0 Limitations) therefore vegetation condition for this area is unknown. The block included paddock (assumed as Completely Degraded) and a stand of trees (1.50 ha) which was not assessed.

Table 20 Vegetation Condition

Condition Rating	Area (ha)	Percentage of Survey area (%)
Excellent	2.38	2
Very Good	4.60	5
Good	6.29	6
Degraded	5.83	6
Completely Degraded	55.07	56
Cleared/Hardstand	22.07	23
Not accessed	1.50	2

Plate 1 Degradation from private use (left) and weed infestations (right)

7.2 Flora

7.2.1 Threatened and Priority Flora

No species listed as Threatened under the BC Act or as Threatened under the EPBC Act were recorded from within the survey area. No Priority flora were recorded.

Four Priority species and two Threatened flora species were considered likely to occur based on the desktop assessment. Following the field survey, this likelihood of occurrence has been revised for five of these species. The likelihood of occurrence for three Priority species are now revised to “may occur”, with one Priority and one Threatened species considered unlikely to occur. All six species are discussed briefly below.

Drosera occidentalis (WA Priority 4)

The habitat for *Drosera occidentalis* includes damp flats of grey sandy clays. Eight *Drosera* spp. were collected and recorded, none of which were identified as *D. occidentalis*. Count date is old from the known record nearby (1980). The habitat in survey area has been altered by rail/road construction and may not provide suitable habitat for this species. The likelihood of occurrence has therefore been revised to may occur.

Johnsonia pubescens subsp. *cygnorum* (WA Priority 2)

This species is known to occur on habitat defined as grey, white and yellow sands, typically on flat terrain and seasonally wet sites. It is also associated with Lambert Lane Reserve which intersects with the survey area. *Johnsonia* spp. was collected at this location but was not identified as the Priority species. The known record nearby is from 1992 and as such this species may not occur in this remnant vegetation anymore. Despite not recording this species, it should be noted that it was a single-season survey. There is a known population nearby, with additional survey effort this species may be recorded in the survey area. As such, it remains likely to occur.

Schoenus pennisetis (WA Priority 3)

Known from Brickwood Reserve where it was last recorded in 2007 associated with the wetland. The habitat for this species is defined as grey or peaty sand to sandy clays, associated with swamps and winter-wet depressions. This species may have been omitted due to survey timing. All wetland communities were dry during the survey and numerous sedges had no identification material. It is also possible that this species does not occur in the survey area due to the altered state of wetland hydrology and condition in the survey area. However, given the presence of suitable habitat and proximity of known locations, it is possible that with additional survey effort this species occurs in the survey area.

Synaphea sp. Serpentine (G.R. Brand 103) (EPBC and WA Critically Endangered)

One record is noted in Lambert Lane Reserve from 1995, as well as 52 known records in the vicinity of the survey area. This species is associated with flat terrain on grey-brown sandy loams to clay in seasonally wet areas. A *Synaphea* collection was made and submitted to the herbarium for formal identification but was not identified as the Threatened species. Suitable habitat exists for this species within the survey area and the species is still considered to be likely to occur.

Tetraria australiensis (EPBC and WA Vulnerable)

Preferred habitat type for *Tetraria australiensis* based on previous records is low plains, slopes and low dunes with white/grey sand, yellow/grey sand and brown/yellow sands in Eucalypt woodlands. There are numerous records in the vicinity, all south of the survey area. Following the field survey and understanding the habitat, it is unlikely that this species is present given the heavy soil types of the survey area that are unsuitable for this species.

Verticordia lindleyi subsp. *lindleyi* (WA Priority 4)

Known from eleven records west of the survey area where it has been found on white/grey/yellow sands, often with or over clay and gravel, associated with winter-wet areas. *Verticordia lindleyi* subsp. *lindleyi* also frequently occur in heath, shrubland and open woodland. The most recent record for this species in the vicinity is 1990. Following the field survey, it is now considered unlikely that this species occurs given the unsuitable soil types recorded.

7.2.2 Inventory of Flora Species

A total of 167 species from 93 genera and 39 families were recorded within the survey area during the field assessment. Families with the highest representation are Fabaceae (17 species), Cyperaceae (16 species), and Myrtaceae (16 species).

The full list of vascular flora species recorded and representative communities in which they occur in are presented in Appendix B. Qualitative data recorded from individual quadrats is presented in Appendix C

It is estimated that approximately 70% of total species richness was captured during the survey. This is represented by a species-area curve. First order and second order jack-knife estimates of the total flora for the survey area based on quadrat records were 254 and 291 taxa respectively. Chao2 classic and Chao2 bias corrected estimates were 263 and 256 taxa respectively. Based on the above estimates, the survey effort represents approximately 69-71% total flora species were sampled and recorded during the survey.

Several (four) orchid species were found but unable to be confidently identified due to insufficient material. None of these represented a genus wherein which Threatened species occur (i.e. *Diuris* sp.).

7.2.3 Weed Species

A total of 21 weed species were recorded in the survey area. This does not represent a comprehensive weed list as the survey and quadrat locations focussed on native vegetation in good or better condition.

Two Declared Pests listed under the BAM Act were recorded including: **Zantedeschia aethiopica* (Arum Lily) and **Rubus ulmifolius* (Blackberry). The Arum Lily is exempt from management in WA, while the Blackberry is listed as C3 – Management / Exempt where some form of management should be applied to alleviate the harmful impacts of this species.

Large **Watsonia* infestations were recorded near Brickwood Reserve which have the potential to invade adjacent native vegetation and cause further degradation.

Plate 2 Weeds including Watsonia infestations (left) and Blackberry (right)

7.3 Fauna

7.3.1 Level 1 Fauna Survey

7.3.1.1 Fauna Inventory

Thirty-seven vertebrate fauna species were recorded within the survey area during the field survey. This comprised four reptile, one amphibian, six mammal and 26 bird species. The observed species are presented in Table 21.

7.3.1.2 Conservation Significant Fauna Species

Six of the 37 vertebrate fauna species recorded were of conservation significance, including five bird and one mammal species. These include:

- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act). Refer to Section 7.4 for further details.
- Carnaby's Cockatoo *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the BC Act). Refer to Section 7.4 for further details.
- Baudin's Cockatoo *Calyptorhynchus baudinii* (listed as Endangered under the EPBC Act and the BC Act). Refer to Section 7.4 for further details.
- Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA) recorded directly and indirectly (scat and diggings) within the survey area. Refer to Plate 3 for photographs of typical conical shaped diggings recorded within the survey area.
- Magpie Lark *Grallina cyanoleuca* and Rainbow Bee-Eater *Merops ornatus* (listed as Marine under the EPBC Act). Species listed as Marine under the EPBC Act are considered significant in Commonwealth land and as the survey area does not contain Commonwealth land these species will not be further discussed within the report.

Refer to Table 16 and Appendix A for further detail on these conservation significant species. Based on the habitat present, all ten species identified within the desktop assessment as “likely to occur” or “may occur” retain their previously determined likelihood of occurrence. Potentially suitable habitat for these species occurring within the survey area are described in Table 22.

Table 21 Fauna species recorded within the survey area

Species	Vernacular	Status	Observations
Birds			
Anthochaera carunculata	Red Wattlebird	Native	Commonly observed throughout survey area
Ardea pacifica	White-necked Heron	Native	Observed in southern wetland
Platycercus zonarius	Australian Ringneck	Native	Commonly observed throughout and flying over the survey area
Cacatua sanguinea	Little Corella	Native	Observed flying over survey area
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Native	Direct observations and foraging evidence recorded throughout survey area
Calyptorhynchus baudinii	Baudin's Cockatoo	Native	Direct observations and foraging evidence recorded throughout survey area
Calyptorhynchus latirostris	Carnaby's Cockatoo	Native	Direct observations and foraging evidence recorded throughout survey area
Chenonetta jubata	Australian Wood Duck	Native	Pair observed in southern wetland
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Native	Observed in Marri trees in southern section of survey area
Corvus coronoides	Australian Raven	Native	Commonly observed throughout survey area
Cracticus tibicen	Australian Magpie	Native	Commonly observed throughout survey area
Cacatua roseicapilla	Galah	Native	Commonly observed throughout and flying over the survey area
Gerygone fusca	Western Gerygone	Native	Commonly seen and heard throughout the survey area
Grallina cyanoleuca	Magpie Lark	Native	Commonly observed throughout and flying over the survey area
Gavicalis virescens	Singing Honeyeater	Native	Commonly observed throughout survey area
Merops ornatus	Rainbow Bee-eater	Native	Heard in survey area
Pardalotus striatus	Striated Pardalote	Native	Observed and heard several times in the survey area
Petrochelidon ariel	Fairy Martin	Native	Observed several times flying over southern survey area and nesting in powerlines
Petroica boodang	Scarlet Robin	Native	Observed in Marri woodland in central survey area
Phaps chalcoptera	Common Bronzewing	Native	Observed in suburban planted vegetation to north of survey area
Platycercus spurius	Red-capped Parrot	Native	Two birds observed in Marri tree
Phylidonyris novaehollandiae	New Holland Honeyeater	Native	Observed in suburban planted vegetation to north of survey area
Rhipidura leucophrys	Willie Wagtail	Native	Commonly observed throughout survey area
Smicrornis brevirostris	Weebil	Native	Observed within survey area
Todiramphus sanctus	Sacred Kingfisher	Native	Recorded twice in Marri trees in southern section of survey area
Trichoglossus moluccanus	Rainbow Lorikeet	Introduced	Commonly observed throughout survey area

Species	Vernacular	Status	Observations
Mammals			
Canis familiaris	Dog	Introduced	Scat observed within survey area
Isoodon fusciventer	Southern Brown Bandicoot	Native	Scat, diggings and individuals observed several times throughout survey area
Equus caballus	Horse	Introduced	Observed in paddocks
Felis catus	Cat	Introduced	Prints observed in several areas
Oryctolagus cuniculus	Rabbit	Introduced	Scat and diggings observed throughout survey area
Vulpes vulpes	Fox	Introduced	Fox dens and scat observed several times throughout survey area
Reptiles			
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink	Native	Observed on fallen tree in survey area
Egernia kingii	King's Skink	Native	Observed in Marri woodland in central survey area
Pseudonaja affinis affinis	Dugite	Native	Observed in southern and central survey area
Tiliqua rugosa	Bobtail Lizard	Native	Observed twice in survey area
Amphibians			
Crinia glauerti	Clicking Froglet	Native	Heard several times in drainage lines throughout survey area

Plate 3 Typical conical shaped Southern Brown Bandicoot diggings

7.3.1.3 Introduced Species

Six introduced and naturalised exotic species were recorded during the field survey. The species and their legal status under the BAM Act are listed below:

- Cat *Felis catus* – Permitted – s11
- Dog *Canis familiaris* – the domestic dog is Permitted – s11; the feral dog is Declared Pest - s22(2) (C3 Exempt)
- Horse *Equus caballus* - Permitted - s11
- European Wild Rabbit *Oryctolagus cuniculus* – Declared Pest – s22(2) (C3 Prohibited)
- Rainbow Lorikeet *Trichoglossus haematodus* - Declared Pest - s22(2) (C3 Exempt)
- Red Fox *Vulpes vulpes* - Declared Pest – s22(2) (C3 Prohibited).

The Rabbit, Feral Dog, Fox and Rainbow Lorikeet are listed as Declared Pests under the BAM Act. Generally, these species were recorded sporadically throughout the survey area and were observed directly, or identified by tracks, scats and burrows.

Refer to Section 3.0 for explanations of BAM Act categories.

7.3.2 Fauna Habitat

The survey area is a north-south corridor approximately 11 km in length, and generally 50 – 100 m in width, though it contains several short east-west sections. The survey area follows the rail line and major arterial roads and much of the area is either cleared or hardstand. It generally contains fauna habitats surrounding and impacted by clearing and edge effects, though it does still contain several smaller areas of good quality fauna habitat.

Seven (including Cleared) broadly defined fauna habitats have been mapped within the survey area (Table 22 and Figure 4). Other than cleared areas, the most common fauna habitat is the Eucalypt Woodland. This habitat is highly variable generally contains Marri *Corymbia calophylla* over an open shrubland over an open sedge layer. It also contains smaller areas with scattered large introduced eucalypts and Sheoak. Significant habitat characteristics include; bare ground is common, trees contain small (common) and large (rare to occasional) hollows, dense understorey is occasionally present, various sizes of logs are present (generally common), as are decorticating bark and a course and fine leaf litter. Habitat quality is considered high to moderate depending on the levels of degradation and modification, and the levels of complexity.

The Eucalypt Woodland habitat occupies 12.07 ha (12%) of the survey area. This habitat may be utilised as breeding, roosting and foraging habitat by the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*, Carnaby's Cockatoo *Calyptorhynchus latirostris* and Baudin's Cockatoo (*Calyptorhynchus baudinii*) depending on tree species present, provides potential habitat for the South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger*, Quenda *Isoodon fusciventer* and Peregrine Falcon *Falco peregrinus,* and provides marginal habitat for the Chuditch *Dasyurus geoffroii* and Inornate Trapdoor Spider *Euoplos inornatus*. This habitat is also likely to be utilised by many of the common fauna species in the area.

Table 22 describes these fauna habitats, includes the area and percentage these cover within the survey area, and the conservation significant fauna species with potential to utilise these habitats.

7.3.3 Fauna Habitat Linkages

Habitat linkages are typically areas or corridors of vegetation that link (larger) areas of fauna habitat. Linkages are important as they enable fauna to move freely between remnant bushland patches, therefore increasing gene-flow between populations. A study conducted by Gilbert *et al.* (1998) found that corridors and/or linkages do maintain species richness in the fragmented landscapes.

The survey area is located on the edge of a metropolitan area with significant amounts of cleared and highly modified land. Although the survey area does not appear to contain any significant linkages, it does contain several degraded drainage lines that may enable some taxa to move through the area. It also sits adjacent Brickwood Reserve and may enable some gene flow through this area, although there are major roads between the survey area and Brickwood Reserve.

Table 22 Fauna habitats of the survey area

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
Scattered Trees This habitat is varied but generally contains scattered eucalypts (often Marri and / or introduced) over a predominantly cleared and maintained understorey. Trees contain small and large hollows. Various sizes of logs are present. Decorticating bark and a coarse and fine leaf litter layer is present – mainly restricted to underneath trees. Abundant bare ground is present, often with a high weed cover. Although it lacks any significant understorey and the associated complexity this would add, it is considered moderate to high quality fauna habitat due to the age and maturity of the trees present.	• Potential breeding, roosting and foraging habitat for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* - Baudin's Cockatoo *Calyptorhynchus baudinii* • Potential habitat for: - South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger* - Quenda *Isoodon fusciv*enter • Marginal habitat for: - Peregrine Falcon *Falco peregrinus* - Chuditch *Dasyurus geoffroii*	11.82	12	

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
				 

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
Wetlands, Drainage and Riparian Vegetation This habitat is highly variable and contains degraded drainage lines with overstorey of Marri and Flooded Gums, riparian shrublands and small wetlands areas. The habitat is considered high to moderate quality due to its wetland and riparian nature, but often reduced in quality due to degraded nature, with high weed cover and high disturbance levels.	• Potential breeding, roosting and foraging habitat (where areas contain appropriate flora species) for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* - Baudin's Cockatoo *Calyptorhynchus baudinii* • Potential habitat for: - Quenda *Isoodon fusciv*enter • Marginal habitat for: - Water-rat *Hydromys chrysogaster* - Carter's Freshwater Mussel *Westralunio carteri*	3.39	3	 

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
				
Eucalypt Woodland This woodland generally contains Marri *Corymbia calophylla* over an open shrubland over an open sedge layer. Also contains smaller areas with scattered large introduced eucalypts and Sheoak. Bare ground is common. Trees contain small (common) and large (rare to occasional) hollows. A dense understorey is occasionally present. Various sizes of logs are present (generally common), as are decorticating bark and a course and fine leaf litter. Habitat quality is variable depending on the level of degradation with some areas highly degraded with highly modified understorey containing shrubs and	• Potential breeding, roosting and foraging habitat for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* - Baudin's Cockatoo *Calyptorhynchus baudinii* • Potential habitat for: - South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger*	12.07	12	

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
high weed cover. Habitat quality is considered high to moderate quality due to the levels of complexity.	- Quenda *Isoodon fusciv*enter - Peregrine Falcon *Falco peregrinus* • Marginal habitat for: - Chuditch *Dasyurus geoffroii* - Inornate Trapdoor Spider *Euoplos inornatus*			
Eucalypt Woodland / Wetland This is generally the transition from Eucalypt woodland to wetland or a mosaic of these habitats. Habitat quality is variable depending on the level of degradation with some areas highly degraded with highly modified understorey containing shrubs and high weed cover. Habitat quality is considered high to moderate quality due to the levels of complexity.	• Potential breeding, roosting and foraging habitat for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* - Baudin's Cockatoo *Calyptorhynchus baudinii* • Potential habitat for: - South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger*	3.86	4	

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
	- Quenda *Isoodon fusciv*enter - Peregrine Falcon *Falco peregrinus* • Marginal habitat for: - Chuditch *Dasyurus geoffroii* - Inornate Trapdoor Spider *Euoplos inornatus* - Water-rat *Hydromys chrysogaster* - Carter's Freshwater Mussel *Westralunio carteri*			
Grassland with Occasional Tree This habitat contains an open grassland with the occasional tree (generally eucalypt). Habitat contains abundant bare ground. The habitat is considered moderate to low quality due to limited complexity and often degraded condition.	• Marginal habitat for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* - Baudin's Cockatoo *Calyptorhynchus baudinii* - Quenda *Isoodon fusciv*enter	1.26	1	n/a

Description	Conservation Significant Species Potentially Utilising Habitat	Area (ha)	% of survey area	Photograph
Shrubland This habitat contains degraded roadside vegetation of limited quality with abundant bare ground, high weed cover and edge effects, and higher quality mixed native shrublands.	• Potential habitat for: - Carnaby's Cockatoo *Calyptorhynchus latirostris* - Baudin's Cockatoo *Calyptorhynchus baudinii* - Quenda *Isoodon fusciv*enter	2.51	3	
Cleared This habitat has been predominantly cleared and it includes tracks, paddocks, roadside etc. It may contain a high vegetative cover of weeds / grasses, and the occasional tree or shrub, and is generally low quality fauna habitat.		36.06	37	

Notes: - an additional 4.72 ha (4.8) of the survey area was not accessed due to private property access issue
- 22.68 (23%) of the survey area was mapped as Hardstand (houses, roads, rail-lines etc.) which provides minimal fauna habitat.

7.4 Black Cockatoos

7.4.1 Ecology

7.4.1.1 Carnaby's Cockatoo

Carnaby's Cockatoo *Calyptorhynchus latirostris* is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill. Carnaby's Cockatoo is a seasonal visitor to the Swan Coastal Plain, which provides important foraging and roosting habitat during the non-breeding season.

Carnaby's Cockatoo feeds on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia*, *Grevillea* and *Hakea*), Marri *Corymbia calophylla*, Jarrah *Eucalyptus marginata*, and seeds from the cones of Pine *Pinus* sp. trees. Cockatoo flocks follow vegetation corridors and actively avoid cleared and open areas when moving between roosting, water and food resources. Habitat fragmentation increases the distances cockatoos need to travel between resources. Proximity of foraging habitat and water has been demonstrated to be critical to support roosting and breeding sites (Le Roux, 2017).

Carnaby's Cockatoo displays strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum *Eucalyptus salmonophloia*, York *Gum E. loxophleba* subsp*. loxophleba*, Flooded Gum *E. rudis*, Karri *E. diversicolor,* Wandoo *E. wandoo* and Tuart *E. gomphocephala* and Marri *Corymbia calophylla*, (DSEWPaC, 2012). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr,1998).

Carnaby's Cockatoo has undergone a dramatic decline of approximately 50 percent in the past 45 years, with the main contributing factors the clearing of core breeding habitat in the Wheatbelt, the deterioration of nesting hollows, and clearing of foraging habitat.

Breeding habitat for this species occurs in the Wheatbelt, Jarrah Forest and South Coast regions, and the species is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP. After breeding, Carnaby's Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July. Breeding has been recorded from early July to mid-December.

Carnaby's Cockatoos were directly observed on two occasions during the survey. Six Carnaby's Cockatoo were recorded flying southeast over survey area, and a flock of approximately 40 birds were observed flying south over the survey area.

7.4.1.2 Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPaC, 2012). It has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri *Corymbia calophylla* and Jarrah *Eucalyptus marginat*a seeds, but also feeding on Blackbutt *E. patens*, Albany Blackbutt *E. staeri*, Karri *E. diversicolor*, Sheoak *Allocasuarina sp.* and Snottygobble *Persoonia longifolia* (Johnstone, 2016 pers. comm.).

Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5 to 33 m above ground. Most nests are in very large and very old, mature Marri (Johnstone, Kirkby & Sarti, 2013), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.). Breeding habitat for this species occurs in the eastern margins of the Jarrah forests of the Wheatbelt, and within the Jarrah Forest regions, and the Forest Red-tailed Black Cockatoo is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP.

Forest Red-tailed Black Cockatoo were observed on two occasions within the survey area. Two birds were observed flying south over the survey area, and a small flock was also observed flying over the survey area.

7.4.1.3 Baudin's Cockatoo

Baudin's Cockatoo *Calyptorhynchus baudinii* is distributed throughout the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Storr, 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin's Cockatoo forages primarily in eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri *Corymbia calophylla*, and seeds of *Eucalyptus* and proteaceous species (e.g. *Banksia* and *Hakea*), as well as orchard fruits and Pines *Pinus* sp. It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of *Xanthorrhoea* and the pith of *Anigozanthos flavidus* (Johnstone & Kirkby, 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri *Eucalyptus diversicolor*, Marri *Corymbia calophylla*, Wandoo *Eucalyptus wandoo* and Tuart *Eucalyptus gomphocephala* (DSEWPaC, 2012b). Baudin's Cockatoo nests in spring in the deep southwest of Western Australia.

Flocks of Baudin's Cockatoo were observed on four separate occasions in or adjacent the survey area, comprising:

- eight Baudin's Cockatoos flying north over the survey area
- 12 Baudin's Cockatoos flying south over the survey area
- flock of several Baudin's Cockatoos heard to the southwest of the survey area
- five Baudin's Cockatoo observed in introduced eucalypts in the survey area.

Refer to Figure 5 for the locations of these observations.

7.4.2 Roosting

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). Evidence of roosting usually involves large amounts of bird scat beneath a large, mature tree, with a significant amount of broken branches on the ground. Roosting sites were searched for throughout the survey area, but no black cockatoo roost sites were identified. BirdLife (2018) notes only one confirmed roost site directly adjacent (within 500 m) the survey area. This is site SERDARR0 and is a white-tailed and Forest Red-tailed Black Cockatoo roost site.

7.4.3 Foraging habitat

7.4.3.1 Carnaby's Cockatoo

The survey area contains a total of 34.40 ha of foraging habitat for Carnaby's Cockatoo. This includes 19.14 ha of Very High and High Quality foraging habitat. This generally consisted of eucalypt woodlands and scattered mature eucalypts on the Swan Coastal Plain containing potential breeding trees and Marri. Foraging habitat is presented in Figure 5, and total areas for each foraging quality are presented in Table 23. The foraging quality assessments are presented in Appendix E.

Carnaby's Cockatoo foraging evidence was recorded at five locations within the survey area (refer to Table 24 and Figure 5).

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metres

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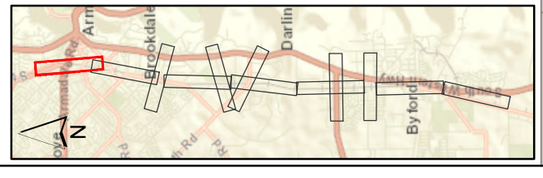
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees
- Tree could not be assessed due to visual/access issues

Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.1

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

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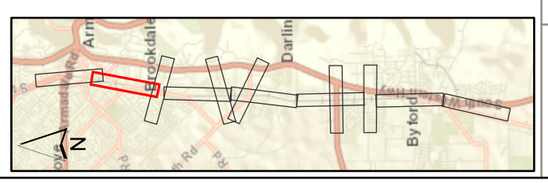
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure **5.2**

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

Probable old chewing on Marri nuts

Probable old chewing on Marri nuts

Probable recent chewing on Marri nuts

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Black Cockatoo Breeding Trees

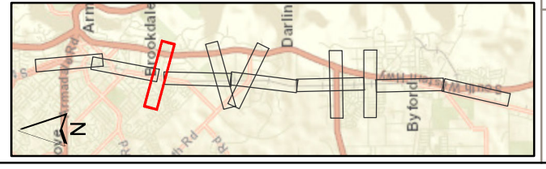
Potential Black Cockatoo Breeding Trees

Tree could not be assessed due to visual/access issues

Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.3

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

Probable old chewing on Marri nuts

Probable old chewing on Marri nuts

Probable recent chewing on Marri nuts

Probable old chewing on Marri nuts

Probable old chewing on Marri nuts

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- Wandoo

Black Cockatoo Foraging Habitat
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- Quality
- High Quality
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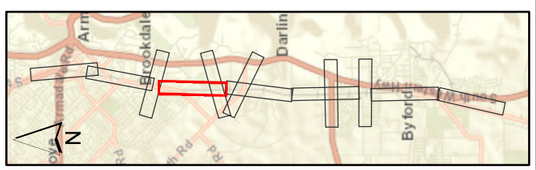
☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.4

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

Probable old chewing on Marri nuts

Probable old chewing on Marri nuts

Probable recent chewing on Marri nuts

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- Introduced
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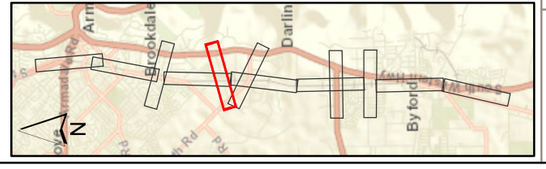
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.5

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metres

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- Potential Black Cockatoo Breeding Trees
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Tree Species
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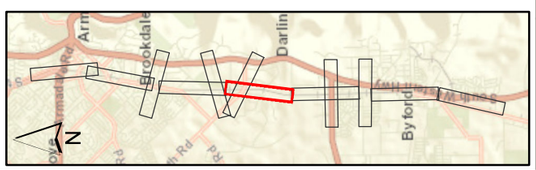
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.6

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metres

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- Black Cockatoo Breeding Trees
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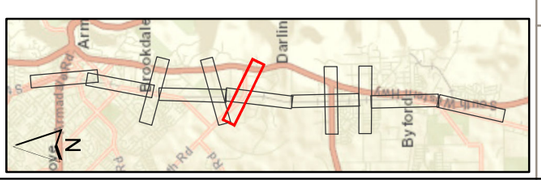
Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- ☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.7

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

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0 50 100
metres

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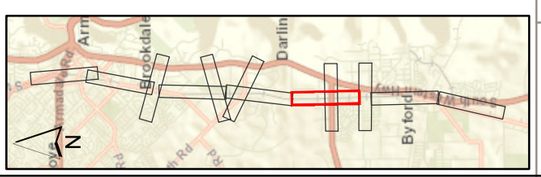
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees
- Tree could not be assessed due to visual/access issues

Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.8

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A3 size

Carnaby's Cockatoo Foraging Habitat

Baudin's Cockatoo Foraging Habitat

Forest Red-tailed Black Cockatoo Foraging Habitat

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DATUM GDA 1994 MGA Zone 50

0 50 100

metres

N

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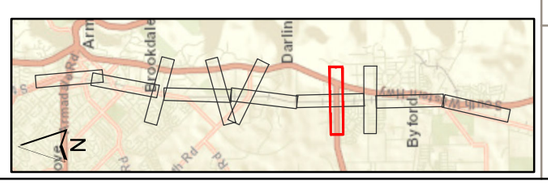
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees
- Tree could not be assessed due to visual/access issues

Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- ☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure 5.9

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60615333\900_CAD_GIS\920_GIS\02_MXDs\03_Byford_ReportFigures\G60615333_Fig5_BCForagingHabitat_A3L_v3.mxd (WyattK2)

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DATUM GDA 1994 MGA Zone 50
0 50 100
metres

N

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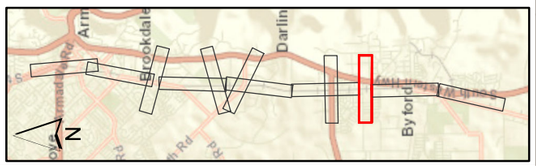
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees
- Tree could not be assessed due to visual/access issues

Tree Species
- Flooded Gum
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- ☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.10

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metres

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Tree Species
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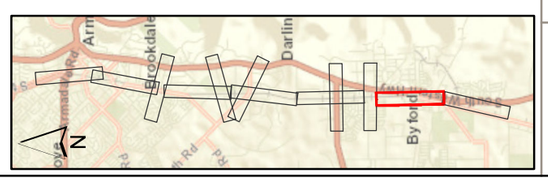
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

- ☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

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Figure 5.11

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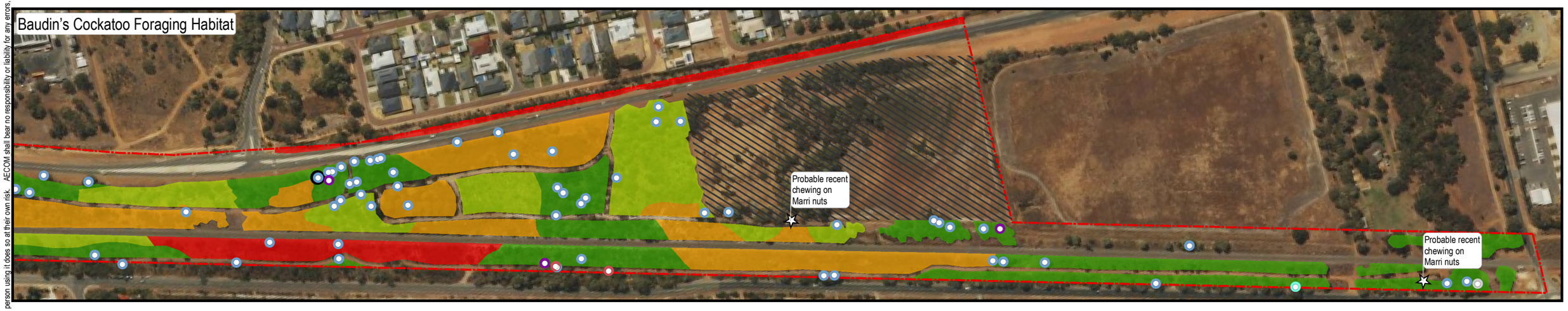
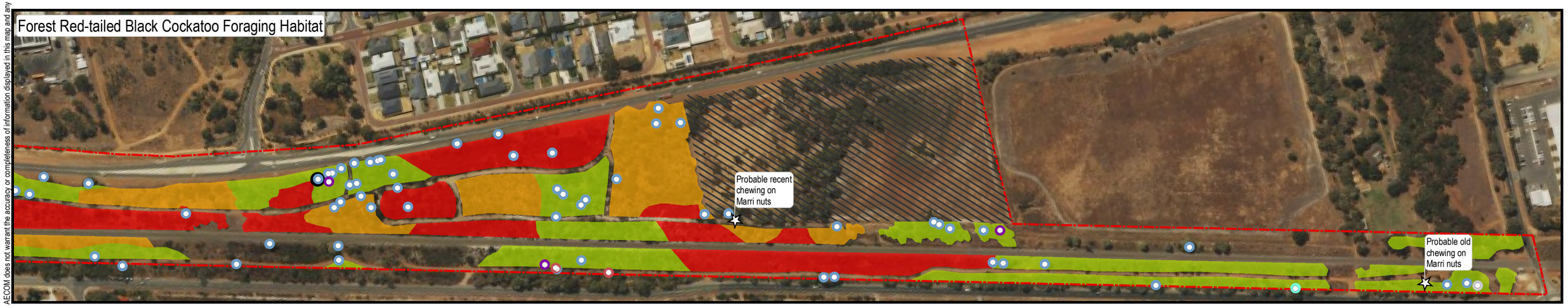
A3 size





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- Potential Black Cockatoo Breeding Trees
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Tree Species
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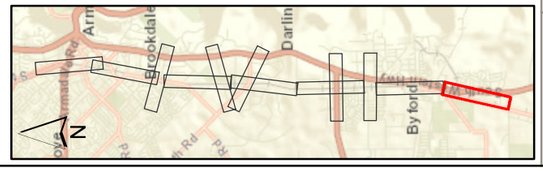
- Introduced
- Jarrah
- Marri
- Stag
- Tuart
- Wandoo

Black Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality
- Not Accessed

- ☆ Opportunistic Fauna Observations



Black Cockatoo Foraging Habitat

PUBLIC TRANSPORT AUTHORITY

BYFORD EXTENSION PART ONE – FLORA AND FAUNA ASSESSMENT

Figure 5.12

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A3 size

Table 23 Carnaby's Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	4.92
Quality (4-6)	10.35
High Quality (7-8)	1.59
Very High Quality (>8)	17.54
TOTAL	**34.40**

Table 24 Potential Carnaby's Cockatoo foraging evidence

ID	Comment	Plate	ID	Comment	Plate
65	Probable recent chewing on Marri nuts		77	Probable recent chewing on Marri nuts	
69	Probable recent chewing on Marri nuts		102	Probable old chewing on Marri nuts	
75	Probable chewing on Marri nuts				

7.4.3.2 Baudin's Cockatoo

The survey area contains a total of 34.40 ha of foraging habitat for the Baudin's Cockatoo. This includes 19.14 ha of High Quality and Very High Quality foraging habitat, which generally consists of This generally consisted of eucalypt woodlands and scattered mature eucalypts on the Swan Coastal Plain containing potential breeding trees and Marri. Foraging habitat is presented spatially in Figure 5, and the total areas for each foraging quality are presented in Table 25. The foraging quality assessments are presented in Appendix E.

No foraging evidence from the Baudin's Cockatoo was recorded within the survey area.

Table 25 Baudin's Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	4.92
Quality (4-6)	10.35
High Quality (7-8)	4.72
Very High Quality (>8)	14.42
TOTAL	**34.40**

Table 26 Potential Baudin's Cockatoo foraging evidence

ID	Comment	Plate	ID	Comment	Plate
67	Probable recent chewing on Marri nuts		109	Probable recent chewing on Marri nuts	
72	Probable chewing on Marri nuts		80	Probable recent chewing on Marri nuts	

7.4.3.3 Forest Red-tailed Black Cockatoo

The survey area contains a total of 29.48 ha of foraging habitat for the Forest Red-tailed Black Cockatoo. This includes 14.42 ha of High Quality foraging habitat, which generally consists of eucalypt woodlands and scattered mature eucalypts on the Swan Coastal Plain containing potential breeding trees and Marri. Foraging habitat is presented spatially in Figure 5, and the total areas for each foraging quality are presented in Table 27. The foraging quality assessments are presented in Appendix E.

Potential foraging evidence from the Forest Red-tailed Black Cockatoo were recorded commonly throughout the survey area (refer to Table 28 and Figure 5).

Table 27 Forest Red-tailed Black Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	10.35
Quality (4-6)	4.72
High Quality (7-8)	14.42
Very High Quality (>8)	0
TOTAL	**29.48**

Table 28 Potential Forest-Red-tailed Black Cockatoo foraging evidence

ID	Comment	Plate	ID	Comment	Plate
66	Probable old chewing on Marri nuts		90	Probable old chewing on Marri nuts	
73	Probable recent chewing on Marri nuts		92	Probable recent chewing on Marri nuts	
79	Probable old chewing on Marri nuts		106	Probable old chewing on Marri nuts	
108	Probable old and recent chewing on Marri nuts		111	Probable old chewing on Marri nuts	

ID	Comment	Plate	ID	Comment	Plate
112	Probable old chewing on Marri nuts		116	Probable recent chewing on Marri nuts	
121	Probable old chewing on Marri nuts		124	Probable old chewing on Marri nuts	
134	Probable recent chewing on Marri nuts		135	Probable recent chewing on Marri nuts	

7.4.3.4 Breeding

Hollow formation in Eucalypt trees is a result of a number of processes including fungal attack, termites and fire, and the propensity for hollow formation varies between species (Whitford, 2002). In order to be suitable for black cockatoos, hollow entrances need to be at least 100 mm in diameter.

A total of 277 native (hollow-forming) potential breeding habitat trees were identified within the survey area. Just over 73% (203) of these were Marri, 26% (53) were Flooded Gums, and the remaining were Jarrah, Stags, Tuart and Wandoo. An additional 37 introduced eucalypts with a DBH >500mm were recorded. On the Swan Coastal Plain most black cockatoo breeding records, particularly for Carnaby's Cockatoo are in Tuart (Johnstone & Kirkby, 2010).

Thirteen of the 277 trees contained a total of 13 potentially suitable hollows for breeding black cockatoos. All were considered to be large enough at their entrances with potentially sufficient floor and chamber space (when observed from the ground). However, hollow depth could not generally be fully inspected from the ground to determine suitability for nesting. Hollow presence in 18 of the 277 native breeding habitat trees could not be fully assessed from the ground due to access issues, trees being on private property, visibility being obscured, or safety reasons.

Refer to Appendix D and Figure 5 for the details of all 277 native and 37 introduced breeding habitat trees.

8.0 Likely Environmental Approvals Required

8.1 Assessment against the Ten Clearing Principles

In assessing whether the Project's proposed clearing is likely to have a significant impact on the environment, the Project was assessed against the Ten Clearing Principles (EP Act, Schedule 5).

a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Comments	Proposed clearing likely to be at variance to this Principle
	The Project Footprint incorporates the entire 98.38 ha survey area of which 20.60 ha represents native vegetation (condition mapped as Degraded or better). Within the Project Footprint, 77.77 ha is not considered to meet the definition of native vegetation in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations). Under the Clearing Regulations planted trees and revegetation are not defined as native vegetation unless they are planted in accordance with a Conservation Covenant. There are no Conservation Covenants that are known to apply to this land and therefore this vegetation is not considered to meet the definition of native vegetation. Within the native vegetation biodiversity was considered high. Three TECs listed under the EPBC Act and BC Act were identified including: • *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Act Endangered, BC Act Critically Endangered) – 6.68 ha. • *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Act Endangered, BC Act Critically Endangered) – 0.18 ha. • FCT8 Herb rich shrublands in claypans (EPBC Act Critically Endangered, BC Act Vulnerable) – 1.57 ha. The survey area supported six woodlands and two shrublands including wetland/riparian vegetation that are likely to represent groundwater dependent ecosystems (6.03 ha). No flora species listed as Threatened under the EPBC Act or BC Act or listed as Priority by DBCA were recorded. Despite this, it is possible that additional survey effort would identify conservation significant flora in the survey area, in particular *Johnsonia pubescens* subsp. *cygnorum* (WA Priority 2) and *Schoenus pennisetis* (WA Priority 3). Seven fauna habitats were mapped (including cleared), with Eucalypt Woodland representing the most common habitat. The Eucalypt Woodland habitat occupies 12.07 ha (12%) of the survey area and provides suitable habitat for: • Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* listed as Vulnerable under the BC Act and the EPBC Act. • Carnaby's Cockatoo *Calyptorhynchus latirostris* listed as Endangered under the BC Act and the EPBC Act. • Baudin's Cockatoo *Calyptorhynchus baudinii* listed as Endangered under the BC Act and the EPBC Act. • Quenda *Isoodon obesulus* listed as a Priority 4 species by the DBCA • South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger* listed as a Conservation Dependent Species under the EPBC Act. The habitat is considered marginal habitat for: • Chuditch *Dasyurus geoffroii* listed as Vulnerable under the BC Act and the EPBC Act • Trapdoor Spider *Euoplos inornatus* listed as Priority 3 by DBCA. Foraging evidence of all three black cockatoos were observed throughout the survey area and both foraging and breeding habitat was recorded.

Comments	Proposed clearing likely to be at variance to this Principle
	Given the above, it is likely that native vegetation within the survey area is considered to support high biodiversity therefore the project is likely to be at variance with this principle.
Methodology	DBCA shapefiles Ecological field surveys

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Comments	Proposed clearing is likely to be at variance to this Principle
	Seven fauna habitats were defined and mapped including cleared. Eucalypt Woodland was the most common habitat, mapped for 12.07 ha (12%). This habitat is highly variable generally contains Marri *Corymbia calophylla* over an open shrubland over an open sedge layer. It also contains smaller areas with scattered large introduced eucalypts and Sheoak. Significant habitat characteristics include; bare ground is common, trees contain small (common) and large (rare to occasional) hollows, dense understorey is occasionally present, various sizes of logs are present (generally common), as are decorticating bark and a course and fine leaf litter. Habitat quality is considered high to moderate depending on the levels of degradation and modification, and the levels of complexity. The field survey and review of the desktop study determined that habitat in the survey area is suitable for five conservation significant fauna species including: • Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* listed as Vulnerable under the BC Act and the EPBC Act. • Carnaby's Cockatoo *Calyptorhynchus latirostris* listed as Endangered under the BC Act and the EPBC Act. • Baudin's Cockatoo *Calyptorhynchus baudinii* listed as Endangered under the BC Act and the EPBC Act. • Quenda *Isoodon obesulus* listed as a Priority 4 species by the DBCA • South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger* listed as a Conservation Dependent Species under the EPBC Act. The habitat is considered marginal habitat for: • Chuditch Dasyurus geoffroii listed as Vulnerable under the BC Act and the EPBC Act • Trapdoor Spider Euoplos inornatus listed as Priority 3 by DBCA. Evidence of the three threatened black cockatoo species was observed in the survey area. The survey area contains foraging habitat for all three threatened black cockatoo species and development of the Project Footprint would require disturbance of: • 34.40 ha of Carnaby's and Baudin's Cockatoo habitat, comprising - 4.92 ha of Low Quality habitat - 10.35 ha Quality habitat - 19.14 ha High and Very High Quality habitat • 29.48 ha of Forest Red-tailed Black Cockatoo foraging habitat comprising: - 7.80 ha Low Quality habitat - 4.72 ha Quality habitat - 14.42 ha High Quality habitat The survey area also contains 277 native breeding habitat trees with a DBH >500 mm.

Comments	Proposed clearing is likely to be at variance to this Principle
Methodology	DBCA Shapefiles Ecological field surveys

c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Comments	Proposal is not likely to be at variance to this Principle
	The desktop assessment identified 83 Threatened and Priority Flora species that could potentially occur within the survey area. Of these, six were considered likely to occur. No flora species listed under the BC Act or EPBC Act were recorded during the field survey. It is possible that with additional survey effort, conservation significant flora species may be recorded. Clearing required to develop the Project Footprint is therefore not likely to be at variance to this principle.
Methodology	DBCA shapefiles Ecological field surveys

d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Comments	Proposed clearing is likely to be at variance with this Principle
	Three TECs listed under the EPBC Act and BC Act were identified including: • *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Act Endangered, BC Act Critically Endangered) – 6.68 ha, high confidence. • *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Act Endangered, BC Act Critically Endangered) – 0.18 ha, low confidence. • FCT8 Herb rich shrublands in claypans (EPBC Act Critically Endangered, BC Act Vulnerable) – 1.57 ha, low confidence. The location of SCP3c means that direct impacts could potentially be avoided through appropriate avoidance and mitigation strategies. The other two TECs are unlikely to be avoidable. As such, the Project is likely to be at variance to this principle.
Methodology	DBCA shapefiles

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Comments	Proposed clearing may be at variance to this Principle
	The National Objectives and Targets for Biodiversity Conservation 2001-2005 (Commonwealth of Australia, 2001) recognises that the retention of 30% or more of the pre-clearing extent in constrained areas of each ecological community is necessary if Australia's biodiversity is to be protected. Two vegetation associations (968 and 3) occur in the survey area. Both of these are above the 30% threshold in the state, but below the threshold on the Swan Coastal Plain (see Table 1). Association 968 has only 6.6% remaining on the Swan Coastal Plain and is below the 10% threshold for the Perth Metropolitan Area. As the extent of this vegetation association is already below the 30% threshold, further clearing required for the project is likely to be at variance within this principle. It is recommended that the Project avoids clearing native vegetation where possible.
Methodology	Government of Western Australia (2018)

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Comments	Proposed clearing is likely to be at variance to this Principle
	Four wetland communities representing GDEs were recorded including: • Woodland: Marri CcHtCa - Represents wetland vegetation and/or ecotone of wetland and modified drainage and Marri Woodlands on uplands. Mapped for 3.22 ha and is Completely Degraded to Very Good • Woodland: Marri CcWmEc –riparian vegetation associated with a waterway. Mapped for 0.22 ha and is Degraded. • Shrubland: Mixed HtNa – riparian vegetation situated on gradual slopes adjacent to basin of wetlands. Mapped for 1.47 ha and is Good to Very Good. • Shrubland: Mixed PeCaBs – riparian vegetation that represents Claypans of the Swan Coastal Plain TEC. Mapped in low-lying areas and basins mapped for 1.12 ha in Good to Very Good condition. These communities are considered GDEs that are regionally and locally significant due to their role in maintaining wetland functions and values. DBCA recommends protection of a minimum 50 m buffer from Conservation Category wetlands (CCWs). The project intersects with seven CCWs and two waterways including Wungong Brook and Cardup Brook. Without management, clearing the Project Footprint could also impact wetlands adjacent to the Footprint. As such, it is likely that the Project is at variance with this principle.
Methodology	DWER and DBCA shapefiles Ecological field surveys

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Comments	Proposed clearing is not likely to be at variance to this Principle
	The Project Footprint is 98.38 ha of which 20.60 ha comprises native vegetation. The Project includes construction of the rail line adjacent to the current Armadale line. Based on the nature and scale of clearing required, development of the Project Footprint is not likely to result in significant changes to salinity, waterlogging, nutrient export or erosion, and is therefore not likely to be at variance with this principle. However, there is potential for some erosion to occur. As a precaution, it is recommended that clearing is minimised where possible, to reduce the potential for land degradation. The project should also be managed in accordance with a Construction Environmental Management Plan (CEMP) that mitigates and/or minimises potential for environmental impacts that can cause land degradation (e.g. erosion, changes to drainage etc). Suitable management measures could include drainage design and controls to prevent scouring and erosion, and dust suppression to minimise wind erosion.
Methodology	

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Comments	Proposed clearing may be at variance to this Principle
	The survey area intersects with numerous wetlands, Bush Forever sites and is adjacent to Brickwood Reserve and Cardup Reserve. Clearing the survey area may have an impact on adjacent environmental values, in particular associated with two waterways and Bush Forever sites. As a precaution it is recommended that any potential impact to adjacent vegetation and water is to be managed through the implementation of appropriate management strategies within a CEMP.
Methodology	DBCA shapefiles

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Comments	Proposed clearing may be at variance to this Principle
	The survey area intersects with two waterways and several CCWs. No significant surface water features occur within the survey area. Clearing may also impact water supply to the lake if it results in changes to runoff patterns. The proposal therefore may be at variance with this principle. It is recommended that clearing is implemented in accordance with a CEMP that includes controls that mitigate impacts to wetland vegetation. This should include dust control and measures to prevent changes to the hydrological regime (e.g. sediment control).
Methodology	DWER and DBCA shapefiles

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Comments	Proposed clearing is not likely to be at variance to this Principle
	Clearing would involve removal of 20.60 ha of native vegetation including 6.03 ha of riparian (GDE) vegetation. Due to the role vegetation plays in reducing surface water runoff, there is potential for clearing to cause changes in the incidence of flooding. The Project intersects with two waterways, already intersected by the current rail corridor. It is likely that with appropriate engineering design and mitigation measures outlined in a CEMP, the potential impact of vegetation clearing on flooding can be adequately managed. It is therefore unlikely to be at variance with this principle. As a precaution, it is recommended that the project avoids clearing native vegetation where possible. Flood risk can be managed by using drainage structures and stormwater management measures included as part of the project design.
Methodology	

8.2 Impact of the Project on Threatened Ecological Communities

Three TECs listed under the EPBC Act and BC Act were identified including:

- *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Act Endangered, BC Act Critically Endangered) – 6.68 ha, high confidence.
- *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Act Endangered, BC Act Critically Endangered) – 0.18 ha, low confidence.
- FCT8 Herb rich shrublands in claypans (EPBC Act Critically Endangered, BC Act Vulnerable) – 1.57 ha, low confidence.

Verification of their presence is recommended through discussions with EPA and potentially additional survey effort.

An action will also require approval if the action has, will have, or is likely to have a significant impact on an ecological community listed as Critically Endangered or Endangered. The Project includes clearing a minimum, 6.68 ha of SCP3a listed as Critically Endangered. At most, the Project will include clearing 8.43 ha of three TECs listed as Critically Endangered or Endangered.

A significant impact on a TEC is presented in Table 29. This assessment is preliminary and addresses the three TECs simultaneously.

Table 29 Significant impact assessment for Threatened Ecological Communities

Significant impact criteria	Assessment
Reduce the extent of an ecological community	**Likely** Removal of between 6.68 ha to 8.43 ha of TEC is considered to reduce the extent of the TECs.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	**Unlikely** The occurrence of TECs are adjacent to the existing rail corridor which has already led to some fragmentation. Clearing is unlikely to cause further fragmentation that may lead to a decline in the ecological attributes of the community.

Significant impact criteria	Assessment
Adversely affect habitat critical to the survival of an ecological community	**Likely** All habitat where the TECs occur are considered critical habitat. As such, any clearing represents an impact to habitat critical to the survival of the TEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	**Possible** One of the TECs is associated with wetlands and occurs inside and outside the survey area. Changes in wetland hydrology as a result of the Project may impact on the TEC adjacent to the survey area.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	**Unlikely** Indirect impacts from train line construction would be mitigated and managed in accordance with the Project CEMP.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	**Unlikely** The occurrences of the TEC are within an existing rail corridor where common weeds and the invasive Watsonia are already present. It is anticipated that indirect impacts associated with weed invasion would be adequately managed through implementation of the CEMP.
Interfere with the recovery of an ecological community.	**Possible** None of the three TECs have recovery plans. The four key approaches to achieve the conservation objectives include protect, restore and research and monitoring. The direct impact of clearing the TECs will lead to further loss of extent and potentially condition.

8.3 Impact of the Project on Black Cockatoo Species

Two threatened black cockatoo species were recorded during the biological survey, Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black-Cockatoo *(Calyptorhynchus banksii naso)*. Foraging evidence of the Forest Red-tailed Black Cockatoo was observed within the survey area and Carnaby's Cockatoo was observed flying over the survey area a number of times.

An evaluation of the proposed action against *EPBC Act 1999: Referral Guidelines for three threatened Black Cockatoo species* (DSEWPaC, 2012) is provided below.

Clearing of any known nesting tree

The survey area contains 277 native breeding habitat trees with a DBH >500 mm, of which 13 contained hollows suitable for the use of breeding black cockatoos. Hollows were identified and observed from the ground using binoculars. Hollow presence in 18 of the 277 breeding habitat trees could not be assessed from the ground due to access issues, trees being on private property, visibility being obscured, or safety reasons.

There was no current breeding evidence observed during the survey. It is recommended that the project avoids clearing of any potential black cockatoo breeding tree. If this is unavoidable, the project is likely to require a referral under the EPBC Act.

Clearing or degradation of any part of a vegetation community known to contain breeding habitat

The survey area includes 12.07 ha of Eucalypt Woodland which may be utilised as breeding, or foraging habitat by the three black cockatoo species. Clearing of this vegetation is likely to require referral under the EPBC Act.

Clearing or degradation of more than 1 ha of quality foraging habitat

Note that Quality in regards to DSEWPaC (2012) Referral Guidelines relates to High Quality and Very High Quality foraging habitat based on our assessment tool. The survey area contains foraging habitat for all three threatened black cockatoo species and development of the Project Footprint would require disturbance of:

- 34.40 ha of Carnaby's and Baudin's Cockatoo habitat, comprising
  - 4.92 ha of Low Quality habitat
  - 10.35 ha Quality habitat
  - 19.14 ha High and Very High Quality habitat
- 29.48 ha of Forest Red-tailed Black Cockatoo foraging habitat comprising:
  - 7.80 ha Low Quality habitat
  - 4.72 ha Quality habitat
  - 14.42 ha High Quality habitat

It is recommended that the Project avoids clearing of black cockatoo foraging habitat. If the Project clears or causes the degradation of more than 1 ha of Quality (or above) foraging habitat it is likely it will require referral under the EPBC Act.

Clearing or degradation of a known night roosting tree:

No night roosting trees were identified within the survey area. The project will not result in the clearing or degradation of a known roosting tree. The Birdlife data notes only one confirmed roost site directly adjacent (within 500 m) the survey area (DBCA, 2019b). This is site SERDARR0 and is a white-tailed and Forest Red-tailed Black Cockatoo roost site.

Creating a gap of more than 4 km between patches of Black Cockatoo habitat:

It is recommended that the project does not clear any black cockatoo foraging habitat or potential black cockatoo breeding trees. However, if this is unavoidable the Project will not create a gap of more than 4 km between patches of black cockatoo habitat.

The survey area is adjacent to, or in close proximity to a number of wetlands, Reserves and Bush Forever sites that contain black cockatoo habitat in similar, if not better quality, to that within the survey area. As such, the Project will not create a gap of more than 4 km between patches of habitat.

8.4 Environmental Approvals

Environmental approvals required for the project will depend on project design and construction requirements, and the potential for significant impacts to the environment. Potential environmental approvals required are summarised in Table 30.

Table 30 Environmental approvals that may be required

Environmental Approval	Government Agency	Description
EPBC Act referral	DAWE	Required if there is potential to have a significant impact on MNES. This would include impacts to flora, vegetation and fauna listed under the EPBC Act. Referral maybe required for impacts on foraging and breeding habitat of black cockatoo species and the Threatened Ecological Communities recorded.
EP Act assessment – Section 48A of EP Act	DWER	Required if there is potential for significant impact on Environmental Factors defined in EPA (now DWER Environmental Services) Guidance. When the EPA receives a referral of a Scheme it must decide whether or not to assess it under section 48A of the EP Act**.** The EPA must also inform the responsible authority in writing of its decision. Assessment under Section 48A of the EP Act may be required for several factors including Flora and Vegetation, Fauna, Terrestrial Environmental Quality, Inland Waters and potentially Social Surrounds.
EP Act Part V - Clearing Permit	DWER	All clearing in Western Australia must be completed under an approved native vegetation clearing permit, unless an exemption is applied under the *Environmental Protection (Clearing of native Vegetation) Regulations 2004* or the Project is assessed under Part IV. The site is within an ESA so no exemptions would apply.
Bed and Banks Permit	DWER	Required if you plan to obstruct or interfere with a watercourse or its banks and surrounds. This will be required for crossing Wungong Brook and Cardup Brook.
Licence to take groundwater	DWER	Required if abstraction of groundwater is proposed. In conjunction with this approval a permit to install a groundwater bore may also be required.
Licence to take surface water	DWER	Required if surface water needs to be taken.
Section 18 of *Aboriginal Heritage Act*	Aboriginal Cultural Material Committee	Section 18 Notice will be required if there is any disturbance to registered Aboriginal heritage sites.

9.0 Conclusions

Ecological assessments including a detailed flora and vegetation, level 1 fauna survey and targeted black cockatoo survey were undertaken for the BRE on behalf of the PTA. The assessment included a desktop assessment, field surveys and data analysis. A summary of the ecological assessments, with a focus on significant findings, is presented below:

- Three TECs were identified and mapped including
  - *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) extending for 6.68 ha.
  - *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered) extending for 0.18 ha. Low confidence from FCT assessment).
  - FCT8 Herb rich shrublands in claypans (EPBC Critically Endangered, WA Vulnerable) potentially occurs near Brickwood Reserve extending for 1.57 ha. Low confidence in this assessment, however TECs are known to occur adjacent and FCT analysis, hydrology and soil characteristics suggest it is present.
- Eight vegetation communities were defined and mapped including six woodlands and two shrublands. Another four significantly modified vegetation types included trees, planted, cleared and hardstand. Of these, four represent wetland communities.
- Vegetation condition was mostly cleared, Completely Degraded (55.07 ha) and Degraded (5.83 ha), with only a small portion mapped as Excellent (2.38 ha), Very Good (4.60 ha) and Good (6.27 ha). Native vegetation represents
- No Threatened or Priority flora was recorded. Justification for this includes the narrow corridor of vegetation remaining after clearing, altered hydrology from the rail embankment, weed invasion, and historical disturbance associated with railway construction.
- Four conservation significant fauna species were recorded including; Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (EPBC Act & WA Vulnerable), Carnaby's Cockatoo *Calyptorhynchus latirostris* (EPBC Act & WA Endangered), Baudin's Cockatoo *Calyptorhynchus baudinii* (EPBC Act & WA Endangered) and Quenda *Isoodon fusciventer* (WA Priority 4).
- Seven (including Cleared) broadly defined fauna habitats were mapped. Other than cleared areas, the most common fauna habitat is the Eucalypt Woodland. This habitat is highly variable generally contains Marri *Corymbia calophylla* over an open shrubland over an open sedge layer. Habitat quality is considered high to moderate depending on the levels of degradation and modification, and the levels of complexity.
- Breeding and foraging and habitat is present for all three Western Australian threatened black cockatoo species. A total of 277 native (hollow-forming) breeding habitat trees were identified within the survey area. Just over 73% (203) of these were Marri, 26% (53) were Flooded Gums, and the remaining were Jarrah, Stags, Tuart and Wandoo. Thirteen of the 277 trees contained a total of 13 potentially suitable hollows for breeding black cockatoos. Foraging habitat included:
  - 19.14 ha of High Quality and Very High Quality foraging habitat for Carnaby's Cockatoo *Calyptorhynchus latirostris* and Baudin's Cockatoo *Calyptorhynchus baudinii*
  - 14.42 ha of High Quality foraging habitat for Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia*.

The ecological assessments were successfully completed with no significant limitations identified.

9.1 Recommendations

The following recommendations are based on the results of this ecological assessment. The high diversity of some sections of the survey area including the presence of conservation significant flora (nearby), and TECs within and adjacent to the survey area warrant targeted survey effort. This will ensure that all ecological values are adequately and accurately captured in a technical report that will inform the environmental assessment process. Recommendations include:

- Flora and vegetation surveys including permanent quadrats in areas of high ecological diversity are recommended with particular emphasis on the three TECs that were defined and mapped. Establishing permanent quadrats in early spring will facilitate a second scoring event in late spring, as recommended in the EPA Technical Guide. Another FCT assessment should be included to verify the inferred FCTs from this study.
- Targeted flora searches for Threatened and Priority species are recommended. These were included as part of this scope however the absence of a species is difficult to ascertain from one survey.
- Further black cockatoo breeding habitat tree hollow assessments could be conducted if any trees with potentially suitable hollows fall within the project footprint (once defined). Additionally, this scope should assess any of the potential breeding trees that could not be assessed completely due to visual or access issues.
- Targeted fauna surveys may be required depending on the level of impact to certain habitats. A targeted survey for Carter's Freshwater Mussel *Westralunio carteri* is recommended depending on potential impacts to suitable wetland areas, and a targeted Chuditch *Dasyurus geoffroii* survey is recommended depending on the potential impacts to the Eucalypt Woodland and Eucalypt Woodland / Wetland fauna habitats. Other conservation significant fauna species that have potential to utilise the habitats of the survey area may be able to be managed through appropriate preclearance surveys and a translocation program prior to clearing, and appropriate protocols during clearing and construction. However, we would recommend early consultation with the regulators over these conservation significant fauna species, once a project footprint has been defined.
- Consultation with regulators to determine the appropriate environmental assessment pathway once the scope of the Project is defined and studies have been undertaken to make informed decisions.

10.0 References

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Appendix A

Desktop Results

Appendix A Desktop Results

Appendix A - Desktop Flora Results

Species	EPBC	WA	Habitat[1]	Count Date	Likelihood of Occurrence (pre-survey)	Likelihood of Occurrence (post-survey)
Acacia benthamii		P2	Typically found on limestone breakaways, and sand. Recorded along the SCP from Dandaragan to Rockingham.	2004	Unlikely. One known record 8km away. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Acacia horridula		P3	Found in gravelly soils over granite, rocky hillsides. Recorded in the Northern Jarrah Forest and Perth IBRA subregions, from Gingin to Serpentine-Jarrahdale.	1996	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J. Keighery 5026)		P1	Grows in swampy areas and winter wet low lands	1982	Unlikely. No recent records, wetlands in survey area historically disturbed (rail/road).	Unlikely to occur.No change from previous assessment.
Acacia oncinophylla subsp. *oncinophylla*		P3	Distributed throughout the south-west, grows on granitic soils	1976	Unlikely. No suitable habitat. One record +10km south of survey area near Serpentine.	Unlikely to occur.No change from previous assessment.
Acacia oncinophylla subsp. *patulifolia*		P4	Species recorded on granitic soils, occasionally on laterite. Located from Gosnells to Wandering.	2008	Unlikely. No suitable habitat. Known records associated with scarp.	Unlikely to occur.No change from previous assessment.
Allocasuarina grevilleoides		P3	Species grows in sand over laterite and gravel	2008	Unlikely. No suitable habitat. Known records associated with scarp.	Unlikely to occur.No change from previous assessment.
Andersonia gracilis	E	VU	Known from Badgingarra, Dandaragan and Kenwick areas where it is found on seasonally damp, black sandy clay flats near margins of swamps in low open vegetation with species such as *Calothamnus hirsutus, Verticordia densiflora* and *Kunzea recurva*	-	Unlikely. No known records in vicinity. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Andersonia sp. *Blepharifolia* (F. & J. Hort 1919)		P2	Recorded on hilltops on red sandy clays or gravel in heathland to woodland.	2017	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Angianthus drummondii		P3	Species grows in grey or brown clay soils and ironstone. Associated with seasonally wet flats.	2012	Unlikely. One known record +10km south. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Anthocercis gracilis	V	VU	Found on sandy or loamy soils, typically on granite outcrops.	-	Unlikley. Identified in Protected Matters Search, no suitable habitat, no known records.	Unlikely to occur.No change from previous assessment.
Aponogeton hexatepalus		P4	Aquatic plant. Species inhabits mud, freshwater areas (ponds, rivers and claypans)	2007	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Asteridea gracilis		P3	Grows in sand, clay and gravelly soils	2015	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Austrostipa jacobsiana	CE	CR	Species recorded in Bunbury and Gosnells, in low lying seasonally wet areas	2015	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Babingtonia urbana		P3	Known from remnant bushland under *Corymbia calophylla* and *Xanthorrhoea preissii* on grey sandy clay sands and damplands.	2015	May. Suitable habitat may be present, several records nearby (5km northwest).	May occur, suitable habitat confirmed as present.
Banksia kippistiana var. *paenepeccata*		P3	Species found in lateritic gravelly soils associated with the Scarp in Jarrah/Marri open woodland.	2005	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Banksia mimica	E	VU	Grows in white or grey sand over laterite, and sandy loam. One population nearby (10km north) associated with *Kingia* and *Byblis*.	1972	May. Old records 10km away from northern tip of survey area.	Unlikely to occur.No change from previous assessment.
Beaufortia purpurea		P3	Species occurs in lateritic or granitic soils and rocky slopes	2015	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Boronia tenuis		P4	Plant grows amongst laterite, stony soils and granite	1966	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Byblis gigantea		P3	Species occurs in sandy-peat swamps and seasonally wet areas.	1992	Unlikely. No peat swamps in survey area.	Unlikely to occur.No change from previous assessment.
Caladenia huegelii	E	CR	Found between Perth and Capel growing in deep sandy soil in *Banksia-Eucalyptus marginata* woodland.	1996	Unlikely. No suitable habitat (deep sandy soils).	Unlikely to occur.No change from previous assessment.
Calectasia cyanea	CE	CR	Species found on white, grey or yellow sand or gravel.	-	Unlikely. No known records.	Unlikely to occur.No change from previous assessment.

Species	EPBC	WA	Habitat[1]	Count Date	Likelihood of Occurrence (pre-survey)	Likelihood of Occurrence (post-survey)
Calothamnus accedens		P4	Found on road verges and grows in sandy soils over laterite. All records nearby associated with Ellis Brook Valley Reserve.	2008	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Calothamnus graniticus subsp. *leptophyllus*		P4	Inhabits clay over granite or lateritic soils, often on hillsides	2005	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Calytrix breviseta subsp. *breviseta*	E	CR	Species occurs on sandy clay and swampy flats.	1915	Unlikely. One very old record in vicinity.	Unlikely to occur.No change from previous assessment.
Calytrix simplex subsp. *simplex*		P1	Florabase (WAH, 1998) records are in heath and Jarrah woodland on Scarp / Jarrah Forest.	1901	Unlikely. Associated with Scarp. No suitable habitat. No known records.	Unlikely to occur.No change from previous assessment.
Carex tereticaulis		P3	Species grows in black peaty sand. Closest record is along Serpentine River.	2009	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Conospermum undulatum	V	VU	Inhabits grey or yellow-orange clayey sand	1908	Unlikely. Known from populations further north. One old record in vicinity.	Unlikely to occur.No change from previous assessment.
Darwinia apiculata	E	EN	Grows amongst Jarrah-Marri woodland on shallow, gravely soil over laterite, or open heathland over sandy loams with granite boulders	2011	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Dillwynia dillwynioides		P3	Grows in sandy soils and winter wet depressions. Known from Lowlands Bushland 12km southwest.	1993	May. Old records +10km southwest. Habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Diplolaena andrewsii	E	EN	Found in loam or clay, along granite outcrops and hillsides.	-	Unlikely. No suitable habitat, no known records.	Unlikely to occur.No change from previous assessment.
Diuris micrantha	V	VU	Recorded between Perth and Boyup Brook growing in seasonally-wet flats amongst sedges and scattered shrubs.	-	May. No known records, suitable habitat may be present.	Unlikely to occur, no suitable habitat.
Diuris purdiei	E	EN	Recorded between Perth and Yarloop, growing under dense shrubs in seasonally-wet swamps and drainage lines. All records except 1 are from pre: 1990s.	2005	May. Suitable habitat may be present, only old records in vicinity.	Unlikely to occur, no suitable habitat.
Drakaea elastica	E	CR	Found on coastal plain between Ruabon and Cataby growing in sandy soil in *Banksia* woodlands and tall shrubs.		Unlikely. No suitable habitat, no known records.	Unlikely to occur.No change from previous assessment.
Drakaea micrantha	V	EN	Species occurs in open sandy patches that have been disturbed where competition from other plants have been removed. It grows in infertile grey sands, in Banksia, Jarrah and Common Sheoak woodland or forest. Is found under thickets of Spearwood with Flying Duck orchid and other *Drakaea* species.	1977	Unlikely. No suitable habitat, no recent records.	Unlikely to occur.No change from previous assessment.
Drosera occidentalis		P4	Recorded in vicinity on damp flats of grey sandy clays.	1990	Likely. Known record from Brickwood Reserve, suitable habitat present.	May occur, suitable habitat present, not recorded.
Eleocharis keigheryi	V	VU	Species occurs in clay, sandy loam and freshwater creeks and claypans.	1982	Unlikely. One record +8km north, no suitable habitat.	Unlikely to occur.No change from previous assessment.
Eriochilus sp. Roleystone (G. Brockman 1140)		P1	Associated with gravelly soils on scarp.	38150	Unlikely. Associated with the Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		P3	Recorded on dry flat brown sand.	1995	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Eucalyptus rudis subsp. *cratyantha*		P4	Grows in loam soils, and inhabits flats and hillsides.	1995	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Eucalyptus x *balanites*	E	CR	Associated with sandy soils with lateric gravel. Population known from Fletcher Park.	2013	May. Survey area very narrow near known population and does not incorporate native vegetation.	Unlikely to occur, no suitable habitat.
Goodenia arthrotricha	E	EN	Species occurs in gravel, granite rocks and slopes.	2005	Unlikely. Associated with the Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Grevillea crowleyae		P2	Species occurs on gravel.	1965	Unlikely. Associated with the Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Grevillea curviloba subsp. *incurva*	E	EN	Species grows in sand to sandy loam, in winter-wet heaths	-	Unlikely. No known records. Known from areas northeast of Perth.	Unlikely to occur.No change from previous assessment.
Grevillea pimeleoides		P4	Species grows in gravelly soils over granite and amongst rocky hillsides.	1965	Unlikely. Associated with the Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.

Species	EPBC	WA	Habitat[1]	Count Date	Likelihood of Occurrence (pre-survey)	Likelihood of Occurrence (post-survey)
Halgania corymbosa		P3	Inhabits gravelly soils and soils over granite	1999	Unlikely. Associated with the Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Isopogon drummondii		P3	Occurs on white, grey or yellow sand, often over laterite. Known record 14km south of survey area.	2003	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Jacksonia gracillima		P3	Grey-black sand, sand dunes, winter wet flats.	2011	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Jacksonia sericea		P4	Species is found on calcareous and sandy soils. DBCA population 11 along Anstey road in vicinity.	1990	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Johnsonia pubescens subsp. *cygnorum*		P2	Species occurs on grey, white and yellow sands, typically on flat terrain and seasonally wet sites.	1992	Likely. Known records in close proximity, suitable habitat present.	Likely to occur. Additional survey effort may identify this species.
Lasiopetalum glutinosum subsp. *glutinosum*		P3	Grows on slopes associated with granite outcrops. Also found on brown clay sands and swampy soils.	2017	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Lasiopetalum pterocarpum	E	CR	Species grows on dark red-brown loam to clayey sand, over granite. Associated with sloping banks near creeklines.	2016	Unlikely. No suitable habitat present.	Unlikely to occur.No change from previous assessment.
Lepidosperma rostratum	E	EN	Grows on peaty sand and clay amongst low heath in winter-wet swamps.	2013	Unlikely. No peaty soils in survey area.	Unlikely to occur.No change from previous assessment.
Meionectes tenuifolia		P3	Semi-aquatic species recorded in seasonally wet aeras. One record nearby in Forestdale Nature Reserve.	2013	Unlikely. No suitable habitat present.	Unlikely to occur.No change from previous assessment.
Millotia tenuifolia var. *laevis*		P2	Association with granite or laterite soils.	2005	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Ornduffia submersa		P4	Aquatic herb associatd with damp claypans. Two records from Scarp nearby.	2004	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Parsonsia diaphanophleba		P4	Species is found on alluvial soils along rivers.	1997	Unlikely. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Pimelea rara		P4	Species grows in the Northern Jarrah Forest, on lateritic soils	1997	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Pithocarpa corymbulosa		P3	Species grows in gravelly or sandy loam, amongst granite outcrops.	2005	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Ptilotus sericostachyus subsp. *roseus*		P1	There is no information on Florabase or from vouchered specimens. Two known locations in vicinity are in cleared areas.	1902	May. No information to make accurate assessment.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Schoenus benthamii		P3	Found on white or grey sand and sandy clay, amongst winter-wet flats and swamps	1994	May. Suitable habitat present, no recent records, no records within 5km.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Schoenus capillifolius		P3	Semi-aquatic species, found in brown mud, claypans.	2013	Unlikely. No suitable habitat.	Unlikely to occur.
Schoenus pennisetis		P3	Species grows on grey or peaty sand to sandy clays, associated with swamps and winter-wet depressions. Known from Brickwood Reserve.	2007	Likely. Known from close proximity, suitable habitat may be present.	Likely to occur. Additional survey effort may identify this species.
Schoenus sp. Waroona (G.J. Keighery 12235)		P3	Grows in sandy clay to clay, in seasonal wetlands.	2012	May. Suitable habitat may be present, one known record in vicinity.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Senecio leucoglossus		P4	Grows on gravelly lateritic or granitic soils, found on granite outcrops and slopes	24/09/1899	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Stackhousia sp. Red-blotched corolla (A. Markey 911)		P3	Recorded on scapr associated with damplands in heath vegetation.	1997	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Stenanthemum sublineare		P2	Grows in littered white sand. One record nearby is from Banksia woodlands.	2003	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Stylidium aceratum		P3	Grows in sandy soils, in swamps.	2013	May occur. Suitable habitat present, not known from wetlands adjacent to survey area.	May occur, suitable habitat present but modified. Several records in vicinity.

Species	EPBC	WA	Habitat[1]	Count Date	Likelihood of Occurrence (pre-survey)	Likelihood of Occurrence (post-survey)
Stylidium longitubum		P4	Species found on sandy clay and clay in seasonal wetlands	2013	May occur. Suitable habitat present, not known from wetlands adjacent to survey area.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Styphelia filifolia		P3	Grows on sandy soils of the coastal, usually in Banksia or Jarrah woodland and in low-lying situations.	2003	May. Suitable habitat may be present.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Synaphea odocoileops		P1	Inhabits brown-orange loam and sandy clay, granite amongst swamps and winter-wet areas. Known record from Serpentine.	1998	Unlikely. No suitable habitat present.	Unlikely to occur.No change from previous assessment.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CE	CR	Endemic to Pinjarra Plain of WA, known from five subpopulations south of Perth from Serpentine to Dardanup. Occurs on grey, clayey sand with lateritic pebbles in low woodland near winter-wet flats.	2003	Unlikely. No suitable habitat present.	Unlikely to occur.No change from previous assessment.
Synaphea sp. Pinjarra Plain (A.S. George 17182)	E	EN	Species recorded throughout the Swan Coastal Plain, in Serpentine-Jarrahdale, Capel and Murray. Grows on grey sandy lam to clay or grey-brown clayey sand or loam. Typically associated with flat terrains and seasonally wet areas.	2012	May. Suitable habitat may be present. Numerous known records nearby.	May occur, suitable habitat present but modified. Several records in vicinity.
Synaphea sp. Serpentine (G.R. Brand 103)	CE	CR	Flat terrain on grey-brown sandy loams to clay in seasonally wet areas.	2003	Likely. Suitable habitat present.	Likely to occur. Additional survey effort may identify this species.
Tetraria australiensis	V	VU	Records in vicinity are from low plains, slopes and low dunes with white/grey sand, yellow/grey sand and brown/yellow sands in Eucalypt woodlands.	2010	Likely. Suitable habitat present.	Unlikely to occur, no suitable habitat.
Thelymitra dedmaniarum	E	CR	Granite, restricted to Jarrah Forest.	-	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Thelymitra magnifica		P1	Grows on stony ridges.	2003	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Thelymitra stellata	E	EN	Sand, gravel, lateritic loam. Grows in *Eucalyptus marginata* forests or in low heath on rocky tops of small hills	1991	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Thysanotus anceps		P3	Occurs on white or grey sand, lateritic gravel and laterite	1997	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Thysanotus glaucus		P4	One known record in vicinity associated with disturbed sandy soils.	1960	May. Suitable habitat may be present. Records old.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Thysanotus sp. Badgingarra (E.A. Griffin 2511)		P2	Grows in grey sand with lateritic gravel.	1996	Unlikely. Associated with Scarp. No suitable habitat.	Unlikely to occur.No change from previous assessment.
Tripterococcus sp. *Brachylobus* (A.S. George 14234)		P4	One record nearby from moist sandy flats on edge of disturbed area.	1990	May. Suitable habitat may be present. Record old.	Unlikely to occur, suitable habitat present but modified, no records nearby.
Verticordia lindleyi subsp. *lindleyi*		P4	Grows in white to grey and yellow sand, often with or over clay and gravel, usually low-lying and winter-wet. Frequently in heath, shrubland and open woodland	1990	Likely. Suitable habitat present.	Unlikely to occur, no suitable habitat.
Verticordia plumosa var. *ananeotes*	E	CR	Species grows in sandy loam and seasonally inundated plains. Populations are restricted to areas of remnant vegetation surrounded by land cleared for agriculture	1900	Unlikely. Two old records, known from Serpentine and Cockburn Sound.	Unlikely to occur.No change from previous assessment.

Appendix A2 - Fauna Desktop Assessment

Scientific Name	Common Name	State	EPBC Act	Last Record	Total Records	PMST	Ecology	Likelihood
Acanthophis antarcticus	Southern Death Adder	P3	-	1963	9		The Southern Death Adder is associated with forests, woodlands, grasslands or heath. Populations in WA and are scattered in the south-west (ALA, 2019)	Unlikely to occur
Actitis hypoleucos	Common Sandpiper	IA	Marine / Migratory			+	The Common Sandpiper is widespread throughout Australia, with few important sites on the continent. They visit Australia during the non-breeding season. Preferred habitat is coastal wetlands with muddy margins or rocky shores but has also been recorded in inland wetlands and dams (DotE, 2015).	Unlikely to occur
Apus pacificus	Fork-tailed Swift	IA	Marine / Migratory			+	The Fork-tailed Swift is almost exclusively aerial, and a non-breeding visitor to Australia (DotE, 2015). They are rarely seen roosting on land.	Unlikely to occur
Ardea alba	Great Egret, White Egret	IA	Marine / Migratory				The Great Egret occupies a wide variety of wet habitats including freshwater wetlands, dams, flooded pastures, estuarine mudflats, mangroves and reefs (Morcombe, 2003). The species is also known to visit shallows of rivers, sewage ponds and irrigation areas (Pizzey & Knight, 2007).	Unlikely to occur
Ardea ibis	Cattle Egret	IA	Marine / Migratory				The Cattle Egret is a small egret weighing only 390g and standing 70cm tall. The heaviest distribution of this species in WA is in the north east, and into the Northern Territory. In the non-breeding season, it can be found throughout most of Australia (DotE, 2015).	Unlikely to occur
Arenaria interpres	Ruddy Turnstone	IA	Marine / Migratory				The Ruddy Turnstone is a stocky, medium build wader with a short wedge shaped bill, orange-red legs and black or dark-brown chest. It is widespread throughout Australia during its non-breeding season. It prefers rocky shores or beaches with rotting seaweed. It breeds in the Northern Hemisphere, but there are several Australian site of international importance in the north of Western Australia and is widespread across the continent during the non-breeding season (DotE, 2015).	Unlikely to occur
Austroconops mcmillani	McMillan's biting midge	P2	-	1934	1		No habitat description available	Unlikely to occur
Bettongia penicillata ogilbyi	Woylie	CR	E			+	The Woylie is a small marsupial with grey to greyish brown fur on the back and flanks, and pale greyish on the undersides. The tail is dark and has a distinctive black brush at the end. The Woylie previously occurred over large areas of western, central and eastern Australia, however naturally occurring extant populations are now restricted to three small reserves in the Western Australian wheatbelt (Van Dyck & Strahan, 2008). They inhabit woodlands and adjacent heaths with a dense understorey of shrubs, particularly *Gastrolobium sp.* (poison pea).	Unlikely to occur
Botaurus poiciloptilus	Australasian Bittern	EN	E			+	The Australasian Bittern is a large thick-necked bird, growing to a length of 66 to 76 cm. Upper parts are brown and black and mottled to aid in camouflage. It grows to a length of 66–76 cm and has a wingspan of 1050–1180 cm. The Australasian Bittern has a straw yellow bill and the legs and feet are pale green to olive (Marchant & Higgins, 1990; Pizzey & Knight, 1997). In Western Australia the species was formerly widespread in the south-west however is now thought to only occur on the western coastal plain, southern coastal region and inland to some wetlands in the Jarrah forests (DSEWPaC, 2011). The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant & Higgins, 1990).	Unlikely to occur
Calidris acuminata	Sharp-tailed Sandpiper	IA	Marine / Migratory			+	The Sharp-tailed Sandpiper is a small to medium sized wader with a length of 17 to 22 cm and weighing 65g. They are widespread in Western Australia from the Pilbara region to the south-west.	Unlikely to occur

Scientific Name	Common Name	State	EPBC Act	Last Record	Total Records	PMST	Ecology	Likelihood
Calidris alba	Sanderling	IA	Marine / Migratory				A small pale wader, reaching 20cm long that breeds in the Northern Hemisphere. This species is almost always found on the coast where they forage in the wave-wash zone and in rotting seaweed (DotE, 2015). This species occurs from the coast near Eyre to Derby, however is more common on the southern and south-west coasts (DotE, 2015).	Unlikely to occur
Calidris ferruginea	Curlew Sandpiper	CR	CE			+	The Curlew Sandpiper is a small, slim weighing 57 g. In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. In Western Australia, they are widespread around coastal and sub coastal plains from Cape Arid to the south-west Kimberley.	Unlikely to occur
Calidris melanotos	Pectoral Sandpiper	IA	Marine / Migratory			+	The Pectoral Sandpiper occupies shallow, fresh waters often containing low grass or other small herbs. It is also observed in swamp margins, flooded pastures and saltmarshes. This species breeds in the northern hemisphere and is a regular though uncommon summer visitor to Australia (Pizzey & Knight, 2007). Rarely recorded in Western Australia (DotE, 2015).	Unlikely to occur
Calidris ruficollis	Red-necked Stint	IA	Marine / Migratory			+	The Red-necked Stint is the smallest wader in Australia and is distributed along most of the Australian coastline, with the greatest densities in Victoria and Tasmania. The nearest internationally important site for the species is the Alfred Cove Nature Reserve on the Swan River (DotE, 2015).	Unlikely to occur
Calidris subminuta	Long-toed Stint	IA	Marine / Migratory			+	The Long-toed Stint breeds in the northern hemisphere, before migrating to northern and coastal Australia where it occupies weedy margins of shallow wetlands, sewage ponds and tidal mudflats (Pizzey & Knight, 2007). In Western Australia records of this species are generally found along the coast (DotE, 2015).	Unlikely to occur
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	V	2018	28	+	The Forest Red-tailed Black Cockatoo is 55-60 cm in length, and are mostly glossy black with a pair of black central tail feathers, a crest, robust bill and bright red, orange or yellow barring in the tail (Higgins, 1999). Males are distinguished by broad red tail panels that are only visible when taking off or alighting (Higgins 1999). Requires tree hollows to nest and breed, occurs in forests of Karri (*Eucalyptus diversicolor*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*), with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone *et al.*, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.	Likely to occur based on recent records and suitable habitat
Calyptorhynchus baudinii	Baudin's Cockatoo	EN	E	2015	68	+	Baudin's Cockatoo is a large cockatoo that measures 50–57 cm in length, with a wingspan of approximately 110 cm. Mostly dull black in colour, with pale whitish margins on the feathers (Higgins, 1999). Habitat critical to the survival of this species includes forests of Karri (*Eucalyptus diversicolor*), Jarrah (E. *marginata*) and Marri (*Corymbia calophylla*), in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al.,* 2010). Breeding has been recorded to the south-west of the area bounded by Leschenault, Collie and Albany (DSEWPaC, 2012), with the most northerly record at Lowden, near Donnybrook (Johnstone & Storr, 1998). Breeding has also been recorded at Serpentine (hills area), and east to Kojonup and near Albany (Johnstone & Kirkby, 2008).	Likely to occur based on recent records and suitable habitat

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Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	E	2013	407	+	Carnaby's Cockatoo is a white-tailed black cockatoo endemic to the south-west of Western Australia. It is a postnuptial nomad and typically moves west soon after breeding. Breeding occurs mainly from early July to mid-December. There has been an apparent shift in its breeding range further west and south since the middle of last century (Johnstone *et al* ., 2010). The species nests in hollows in eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*E. Wandoo*), but nests have been found in other eucalypts including York Gum (*E. loxophleba*), Flooded Gum (*E. rudis*), Tuart (*E. gomphocephala*) and Marri (Corymbia calophylla) (Johnstone *et al* ., 2010). 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 (Johnstone *et al* ., 2010). Diet consists of an array of Proteaceous and *Eucalyptus* species. Foraging habitat, including *Banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al* ., 2010).	Likely to occur based on recent records and suitable habitat
Charadrius dubius	Little Ringed Plover	IA	Marine / Migratory			+	The Little Ringed Plover is a non-breeding visitor to Australia. There are no current known sites of international importance to the species on mainland Australia or offshore islands (Wetlands International, 2008).	Unlikely to occur
Charadrius leschenaultii	Greater Sand Plover	VU	V				The Greater Sand Plover is a medium sized plover, weighing up to 100 g. This species has been recorded at beaches, tidal mudflats, reefs, dunes and is seldom observed far inland (Pizzey & Knight, 2007).	Unlikely to occur
Ctenotus delli	Dell's skink, Darling Range Southwest Ctenotus	P4	-	1969	1		The Darling Range Heath Ctenotus, a small skink that occurs in the Darling Range, inhabiting shrubby understory on lateritic, sandy and clay soils in Jarrah and Marri woodlands.	Unlikely to occur
Ctenotus ora	Coastal Plains Skink	P3	-				Newly defined species since 2012, previously grouped with *Ctenotus labillardieri* . Records have located species in open eucalypt woodland over banksia and low vegetation along the Swan Coastal Plain (Kay & Keogh, 2012).	Unlikely to occur
Dasyurus geoffroii	Chuditch	VU	V	2010	4	+	At maturity the Chuditch is the size of a small domestic cat with white spotted brown pelage,, large rounded ears, pointed muzzle, large dark eyes and non-hopping gait. Following European settlement the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The Chuditch requires adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive.	May occur
Euoplos inornatus	Inornate Trapdoor Spider	P3					*Euoplos* is a spider genus in the family Idiopidae which is found in various geographical locations in Australia. The trapdoor spider species *Euoplos inornatus* occurs on the eastern edge of the SCP, although most records are from the Darling Scarp and the Jarrah forest to the east (Invertebrate Solutions, 2018).	May occur
Falco peregrinus	Peregrine Falcon	OS (7)	-	2004	4		The Peregrine Falcon is a medium-sized raptor (length 35-55cm; wingspan 80-105cm) with slate-grey back, a striking charcoal black head and face which contrast with a pale cream bib on the neck and breast (Birdlife Australia, 2018). A well-known falcon, the Peregrine inhabits a vast array of environs in Australia. Usually uncommon and migratory (Pizzey & Knight, 2007). This species lays its eggs in recesses of cliff faces, tree hollows or large abandoned nests (Bamford, 2009)	May occur
Falsistrellus mackenziei	Western Falsistrelle	P4	-				Recent records of the Western Falsistrelle have been recorded near Stratham and Australind. Species habitat inlcudes high rainfall areas dominated by Jarrah, Karri, Marri and Tuart. Species typically found in mature forest, but has also been recorded from Banksia woodland on the Swan Coastal Plain (Armstrong et al. 2017)	Unlikely to occur
Gallinago megala	Swinhoe's Snipe	IA	Marine / Migratory			+	This species is distributed throughout Western Australia, particularly in the Kimberley region (Johnstone & Storr, 1998).	Unlikely to occur

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Gallinago stenura	Pin-tailed Snipe	IA	Marine / Migratory			+	This species occupies shallow freshwaters and is distributed on the north-west coastal plains but is a casual visitor further south to Perth (Johnstone & Storr, 1998).	Unlikely to occur
Gelochelidon nilotica	Gull-billed Tern	IA	Marine / Migratory				The Gulled-billed Tern are found on all continents except Antarctica, typically near freshwater swamps, brackish and salt lakes, beaches and other water bodies. The species is distributed throughout inland Australia (Birds in Backyards, 2020).	Unlikely to occur
Glacidorbis occidentalis	Jarrah forest freshwater snail	P3	-				Found in the Swan Coastal Plain and South-west regions of Western Australia, Jarrah forest freshwater snails typically inhabit inland waters, and are found on macrophytes, moss, roots, pieces of wood, or under stones (Centre for Freshwater Ecosystems, 2020).	Unlikely to occur
Haliaeetus leucogaster	White-bellied Sea-Eagle	IA	Marine / Migratory				The White-bellied Sea-Eagle is a large raptor that is widespread throughout coastal Australia. The White Bellied Sea-Eagle occupies a wide range of habitats, usually in close proximity to a large body of water (including the ocean). Breeding usually occurs in tall open woodlands overlooking bodies of water (DotE, 2015).	Unlikely to occur
Hydromys chrysogaster	Water-rat	P4	-	2004	3		The Water Rat is one of the few Australian mammals adapted to the aquatic environment. It has a streamlined body and broad, partially webbed hind feet. The species occurs in the vicinity of permanent bodies of fresh or brackish water. Dens are made at the end of tunnels in banks and occasionally in logs (Van Dyck & Strahan, 2008).	May occur
Hydroprogne caspia	Caspian Tern	IA	Marine / Migratory	1994	1		The Caspian Tern has been recorded on both coastal and inland locations throughout Australia. In WA the species is widespread in coastal regions, from the Great Australian Bight to the Dampier Peninsula. There are sparse records on the coasts east of King Sound and in eastern regions (Higgins & Davies 1996).	Unlikely to occur
Idiosoma sigillatum	Shield-backed Trapdoor Spider	P3	-				This species can be found in burrows of heavy clay soils in areas of open York Gum (*Eucalyptus loxophleba)* , Salmon Gum (*E. salmonophloia)* and Wandoo *E. wandoo)* woodland, where *Acacia acuminata* forms a sparse understorey (Avon Catchment Council, 2007).	Unlikely to occur
Isoodon fusciventer	Quenda	P4	-	2016	73		The Quenda or Southern Brown Bandicoot exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	Likely to occur based on recent records and suitable habitat
Ixobrychus dubius	Australian Little Bittern	P4	-				A small, secretive bittern, standing at between 25 cm to 35 cm, the Little Bittern forages among dense low swamp vegetation and on floating water plants. This species occurs in the south-west of Western Australia however it is very uncommon (Pizzey & Knight, 2007).	Unlikely to occur
Kawaniphila pachomai	Grey Vernal Katydid	P1	-				The Grey Vernal Katydid have been recorded within the southern Perth metropolitan area and south-west near Vasse. The species inhabits tree and shrubs and can be found mostly heath or mixed woodland (Rentz, 1993).	Unlikely to occur
Leioproctus douglasiellus	Short-tongued Bee	EN	CE			+	This small black native bee species is known from the SCP (Kenwick wetlands, Cannington and Forestdale Lake) and near Lithgow in the Blue Mountains of NSW (ALA, 2019) and has an association with *Goodenia filiformis* and *Anthotium junciforme* (South Metro Connect, 2011).	Unlikely to occur - neither flora species was recorded in the survey area
Leipoa ocellata	Malleefowl	VU	V			+	The Malleefowl is a large, ground-dwellin bird with strong feet and a short bill. It is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as such as Broombush (Melaleuca uncinata) and Scrub Pine (Callitris verrucosa). In WA Malleefowl distribution was associated with landscapes that had lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures (Benshemesh, 2007).	Unlikely to occur

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Lerista lineata	Perth Slider	P3	-				The Perth Lined Lerista is an underground dwelling skink, sheltering in leaf litter and upper layers of loose soil. It is typically found at the bases of shrubs, spoil heaps and stick ant nests (Bush *et al,* 2010). The species inhabits sandy soils supporting Eucalypt/*Banksia* woodland, coastal heath and low shrubland (Bush *et al.,* 2010; Wilson and Swan, 2010). There are no records of this species north of the Swan River on the Swan Coastal Plain (South Metro Connect, 2011).	Unlikely to occur
Limosa limosa	Black-tailed Godwit	IA	Marine / Migratory			+	The Black-tailed Godwit is found in all states and territories of Australia however it typically inhabits coastal regions and is concentrated in the north of the country. It can be found elsewhere although is usually present in lower numbers (DotE, 2015).	Unlikely to occur
Macronectes giganteus	Southern Giant-Petrel	P4	E				The Southern Giant Petrel is the largest petrel, and has been described as looking like a small, ungainly brown albatross with a massive greenish-tipped straw coloured bill, surmounted by a large single nostril-tube (Pizzey & Knight, 1999). The species is known to occur in Antarctic to subtropical waters. It typically nests in areas of exposed vegetation (DotEE, 2019). It is a marine species and is only known to nest on the Antarctic Continent, surrounding islands and South America, it may however overfly the area.	Unlikely to occur
Merops ornatus	Rainbow Bee-eater	IA	Marine / Migratory				The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests. It is possible that this species will occupy open woodland areas within the survey area. The Rainbow Bee-eater avoids heavy forest that would hinder the pursuit of its insect prey (Morcombe, 2003).	Unlikely to occur
Motacilla cinerea	Grey Wagtail	IA	Marine / Migratory			+	The Grey Wagtail is a scarce but regular visitor to northern Australia, typically arriving in October and leaving in March. The species is most commonly associated with water and are found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (DotE, 2015)	Unlikely to occur
Myrmecobius fasciatus	Numbat	EN		1974	3		Originally widespread, the Numbat now only persists in two remnant populations at Dryandra and Perup in Western Australia with several reintroduced populations in the Western Australian wheatbelt (DotEE, 2019).	Unlikely to occur
Neelaps calonotos	Black-striped Snake	P3					The Black-striped Snake is mostly confined to the Swan Coastal Plain between Mandurah and Lancelin. It takes shelter in upper layers of loose soil beneath leaf litter in Eucalyptus/Banksia woodlands, typically at the base of trees and shrubs (Bush *et al.,* 2010).	Unlikely to occur
Neopasiphae simplicior	Native Bee	EN	CE			+	Species is highly restricted, and only recorded from a single location within the bushland of Forrestdale Lake Nature Reserve (adjacent to the Forresdale Lake and Armadale Golf Course). No other extant populations are known (Houston, 1994).	Unlikely to occur
Notamacropus eugenii subsp. *derbianus*	Tammar Wallaby	P4	-				*Notamacropus eugenii* derbianus is a small nocturnal Tammar Wallaby subspecies that is native to south-western Western Australia and five offshore islands. The mainland population has substantially declined since the 1890s due to habitat clearing, hunting, fire, predation by foxes and cats, and competition with rabbits. Tammar Wallabies shelter in dense low vegetation during daylight and move to open grassy areas to feed after dark. They inhabit coastal scrub, heath, dry sclerophyll forest, and thickets in mallee and woodland (DotEE, 2019).	Unlikely to occur
Notamacropus irma	Western Brush Wallaby	P4	-	1959	2		The Western Brush Wallaby is endemic to the south-west region of Western Australia, and has been recorded from north of Kalbarri and towards Cape Arid. The species inhabits open forest/woodland, mallee, heathland, low open grasslands and thickets. (Woinarksi and Burbidge 2016).	Unlikely to occur

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Numenius madagascariensis	Eastern Curlew	CR	CE			+	The Eastern Curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. The Eastern Curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. It is extremely shy and will take flight at the first sign of danger (DotEE, 2019). The southern most important international site in Western Australia is Eighty Mile Beach (Bamford et al., 2008).	Unlikely to occur
Numenius minutus	Little Curlew	IA	Marine / Migratory			+	The Little Curlew breeds in Arctic Siberia and migrates south to Australia in September, returning by April. When in Australia this species occupies dry grassplains, floodplains, margins of drying swamps, tidal mudflats, crops and sewage ponds (Pizzey & Knight, 2007).	Unlikely to occur
Oxyura australis	Blue-billed duck	P4	-				The Blue-billed Duck is a compact diving duck with males having a large scooped bright, light blue bill. The tail is dark with stiff pointed feather tips and is usually held flat on the surface of the water except when in display (Birdlife Australia, 2019). The Blue-billed Duck is endemic to south eastern and south western Australia. It prefers deep water in large permanent wetlands and swamps with aquatic vegetation. This species of duck is fully aquatic and rarely comes onto land.	Unlikely to occur
Pandion cristatus	Eastern Osprey	IA	Marine / Migratory				The breeding range of the Eastern Osprey includes the northern coast of Australia from Albany in WA to Lake Macquarie in NSW. The total range (breeding plus non-breeding) around the northern coast is more widespread, extending from Esperance in Western Australia to NSW, where records become scarcer towards the south (DotEE, 2019).	Unlikely to occur
Pandion haliaetus	Osprey	IA	Marine / Migratory			+	The Eastern Osprey is a medium-sized raptor with dark-brown to blackish-brown above and white below with a white head and neck; a dark-brown to blackish-brown crest; a black stripe across the eye and ear; a band of reddish-brown, brown or dark-brown streaking across the breast. The breeding range of the Osprey includes the northern coast of Australia from Albany in WA to Lake Macquarie in NSW (DotEE, 2019). The Osprey occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Found mostly in coastal areas but can travel inland along major rivers. Areas of open fresh, brackish or saline water for foraging is essential for their habitat, visiting various wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps and broad rivers, reservoirs and large lakes. They can also occur over atypical habitats such as heath, woodland or forest when travelling between foraging sites.	Unlikely to occur
Phascogale tapoatafa wambenger	Brush-tailed Phascogale	CD	-	No date	2		The Brush-tailed Phascogale is one of the most arboreal dasyurids and rarely feeds on the ground. The species is distinguished by a large black tail. The species formerly occupied all the dry sclerophyll forests and woodlands of temperate and tropical Australia. The species suffered a drastic reduction in habitat due to clearing of prime habitat for agriculture and now prefers open forest with sparse groundcover. It has been observed in habitats ranging from mallee to rainforest.	May occur
Philomachus pugnax	Ruff (Reeve)	IA	Marine / Migratory			+	The Ruff, or Reeve for females, breeds in Eurasia and is a regular, uncommon migrant to coastal Australia where it frequents fresh, brackish and saline wetlands, tidal mudflats and saltfields (Pizzey & Knight, 2007).	Unlikely to occur
Plegadis falcinellus	Glossy Ibis	IA	Marine / Migratory				The Glossy Ibis is slightly smaller than other ibises, reaching 49-55 cm. It occupies well vegetated wetlands, wet pastures, floodwaters, brackish wetlands and mudflats. This species is a non-breeding visitor to south-west Western Australia (Pizzey & Knight, 2007).	Unlikely to occur
Pluvialis fulva	Pacific Golden Plover	IA	Marine / Migratory				The Pacific Golden Plover is a medium sized bird with long legs and seldom recorded in the south west of Western Australia (DSWEPaC, 2012).	Unlikely to occur

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Pluvialis squatarola	Grey Plover	IA	Marine / Migratory				The Grey Plover is a medium sized plover, with the Australian population breeding in Siberia between May and August, with individuals reaching the south coast of Australia in October and November (DotEE, 2019).	Unlikely to occur
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CE			+	This species is restricted to the south-west corner of Western Australia. Closer to the coast it is closely associated with Peppermint (*Agonis flexuosa*) forest and woodland and Tuart (*Eucalyptus gomphocephala*) with a peppermint mid-story. Further from the coast the species is found in Jarrah (*Eucalyptus marginata*), Wandoo (*Eucalyptus wandoo*) and Marri (*Corymbia calophylla*) forest (Van Dyck & Strahan, 2008).	Unlikely to occur
Rostratula australis	Australian Painted Snipe	EN	E			+	The Australian Painted Snipe is a stocky wading bird around 220–250 mm in length with a long pinkish bill.). This species is a very rare summer visitor to the south-west of Western Australia. Breeding habitat in Western Australia is not quite known however a nest located near Moora was located in a tussock beside a swamp (Johnstone & Storr, 1998). The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotEE, 2019).	Unlikely to occur
Setonix brachyurus	Quokka	VU	V	1958	6	+	The Quokka is distributed from Jarrah forest south-east of Perth, extending south through southern Jarrah, Marri and Karri forests onward to the south coast. It is now thought to be absent from the Swan Coastal Plain. Habitat use varies and includes thickets of Acacia, Melaleuca and is sometimes found in conjunction with tea-tree (Van Dyck & Strahan, 2008).	Unlikely to occur
Stercorarius longicaudus	Long-tailed Jaeger	IA	Marine / Migratory				The long-tailed jaeger occurs across the Arctic, Atlantic and Pacific Waters. The species is mostly pelagic, with the distribution in Australia not described (Birdlife, 2019).	Unlikely to occur
Sternula nereis nereis	Fairy Tern	VU	V			+	The Fairy Tern is a small bird weighing approximately 70 g, and is described as bulky and round bodied (Simpson & Day 2004). The breeding plumage of both sexes is pale grey-white, with a black crown, nape, ear coverts and patch in front of the eyes (square to round in shape) (Higgins & Davies 1996). The species is found along coasts of Victoria, Tasmania, South Australia and Western Australia, occurring as far north as the Dampier Archipelago. The Fairy Tern nests on sheltered sandy beaches, spits and banks (DotE, 2015).	Unlikely to occur
Synemon gratiosa	Graceful Sunmoth	P4	-				The Graceful Sun Moth occurs throughout the Swan Coastal Plain and extends north into the Geraldton Sandplain (DEC, 2011). It is associated with two habitat types: 1. Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant *Lomandra maritima*. The Graceful Sun Moth is recorded at substantially higher rates on the *L. maritima* habitat and is therefore more numerous/dense in this coastal habitat (DEC 2011). 2. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant *L. hermaphrodita* is widespread. The relative contribution of the Banksia woodland (*L. hermaphrodita*) habitat to the total population and area of occupied habitat of the Graceful Sun Moth is small (DEC 2011). Dispersal is thought to be limited by fragmentation of habitat (DEC, 2011).	Unlikely to occur
Thinornis rubricollis	Hooded Plover	P4					The Hooded Plover is a medium-sized sandy-brown plover. It has a black head and a white nape, and the black hindneck collar extends around and forks onto the breast. West of the Nullarbor Plain, Hooded Plovers are also often recorded on ocean beaches, but they are just as likely to be seen foraging at salt lakes, sometimes hundreds of kilometres from the coast (Birdlife, 2019).	Unlikely to occur
Trichosurus vulpecula subsp. *arnhemensis*	Northern Brushtail Possum	VU	-				The Northern Brushtail Possum is distributed throughout Australia mainland and offshore islands. The Brushtail Possum is known to occupy a variety of habitats from forest and woodlands that provide sufficient trees with hollows, to ground refuges such as hollow logs. The *arhnhemensis* sub-species has been recorded from the tropical northern Australia, including the Pilbara and Kimberley of Western Australia (DEC, 2012).	Unlikely to occur

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Tringa glareola	Wood Sandpiper	IA	Marine / Migratory			+	The Wood Sandpiper is a summer migrant to Australia where it is more common in the north although a casual visitor to southern parts. It occupies wetland margins, saltmarshes and sewage ponds (Pizzey & Knight, 2007).	Unlikely to occur
Tringa nebularia	Common Greenshank	IA	Marine / Migratory			+	The Common Greenshank is a largely built wader, weighing up to 190 g for both sexes. The species is found in inland wetlands and sheltered coastal habitats (DotE, 2015).	Unlikely to occur
Tringa stagnatilis	Marsh Sandpiper	IA	Marine / Migratory			+	This species breeds from Austria to Mongolia and moves to Australia for summer and is found in mostly coastal areas (Pizzey & Knight, 2007). Scattered records exist in Western Australia and are found mainly near the coast (DotE, 2015). This species occupies wetlands of varying salinity including fresh, sewage ponds and estuaries (Pizzey & Knight, 2007).	Unlikely to occur
Westralunio carteri	Carter's Freshwater Mussel	VU	V	2009	1	+	The only reasonably large bivalve in freshwaters of south-west Western Australia. Occurs in greatest abundance in slower flowing waters with stable sediments that are soft enough for burrowing. Salinity tolerance is quite low (>3 g /L is lethal) (Klunzinger *et al.,* 2012).	May occur

Scientific Name	Common Name	State	EPBC Act	Last Record	Total Records	PMST	Ecology	Likelihood

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Appendix B

Flora Species By Community Matrix

Appendix B Flora Species by Community Matrix

Appendix B - Flora Species by Community Matrix

Family	Species	AfVaLm	AfXpEc	CcAhMt	CcHtCa	CcWmEc	CcXpTo	HtNa	PeCaBs
Amaranthaceae									
	Ptilotus manglesii							x	
Apiaceae									
	Xanthosia candida	x							
Araceae									
	Zantedeschia aethiopica				x				
Araliaceae									
	Trachymene pilosa			x					
Asparagaceae									
	Laxmannia squarrosa						x	x	
	Lomandra ?caespitosa						x		
	Lomandra caespitosa			x					
	Lomandra drummondii	x		x			x	x	
	Lomandra hermaphrodita						x		
	Lomandra micrantha	x					x	x	x
	Lomandra preissii						x		
	Lomandra sonderi							x	
	Thysanotus manglesianus / patersonia complex						x		
	Thysanotus multiflorus	x					x	x	x
	Thysanotus triandrus			x					
Asteraceae									
	Hypochaeris glabra	x					x		x
	Hypochaeris radicata						x	x	
	Pterochaeta paniculata			x					
	Siloxerus filifolius								x
	Ursinia anthemoides			x			x	x	x
Boryaceae									
	Borya ?scirpoidea	x		x			x	x	x
Campanulaceae									
	?Lobelia anceps						x		
Casuarinaceae									
	Allocasuarina fraseriana	x	x				x		
	Allocasuarina humilis			x			x		
Centrolepidaceae									
	Aphelia cyperoides							x	
	Centrolepis aristata						x		
Colchicaceae									
	Burchardia congesta			x			x		
Cyperaceae									
	Cyathochaeta avenacea	x		x	x		x		x
	Isolepis cernua	x						x	x
	Lepidobolus preissianus						x		
	Lepidosperma leptostachyum		x	x	x				
	Lepidosperma pubisquameum						x		
	Lepidosperma sp.			x					
	Lepidosperma tenue						x		
	Mesomelaena stygia subsp. *stygia*			x				x	
	Mesomelaena tetragona	x		x	x		x		x
	Schoenus clandestinus			x					x
	Schoenus efoliatus								x
	Schoenus grandiflorus						x		
	Schoenus pedicellatus						x		
	Schoenus sp.						x		
	Tetraria octandra			x			x		
	Tricostularia neesii								x
Dasypogonaceae									
	Calectasia grandiflora						x		
	Dasypogon bromeliifolius	x					x		x
	Kingia australis			x			x	x	
Dillenaceae									
	Hibbertia hypericoides			x			x		
Droseraceae									
	Drosera erythrorhiza							x	
	Drosera gigantea								x
	Drosera glanduligera						x		x
	Drosera macrantha						x		
	Drosera marchantii	x		x				x	x
	Drosera micrantha								x
	Drosera porrecta			x			x		
	Drosera sp.							x	
Elaeocarpaceae									
	Tetratheca hirsuta subsp. hirsuta						x		
Ericaceae									
	Astroloma pallidum	x							

Family	Species	AfVaLm	AfXpEc	CcAhMt	CcHtCa	CcWmEc	CcXpTo	HtNa	PeCaBs
Fabaceae									
	Acacia alata						x		
	Acacia browniana						x		x
	Acacia lateriticola	x					x	x	
	Acacia pulchella var. glaberrima	x			x		x		
	Acacia saligna						x		
	Acacia sp.			x					
	Acacia sp. (planted)		x		x				
	Daviesia decurrens			x			x		
	Daviesia preissii						x		
	Daviesia triflora	x					x		
	Gastrolobium dilatatum						x		
	Gastrolobium spathulatum			x					
	Gompholobium marginatum	x		x			x		
	Hovea trisperma			x			x		
	Kennedia prostrata					x			
	Labichea punctata						x		
	Lotus angustissimus		x				x		
	Sphaerolobium medium			x					
	Viminaria juncea				x		x		x
Gentianaceae									
	Cicendia filiformis								x
Goodeniaceae									
	Dampiera alata						x		
	Dampiera linearis	x					x	x	x
	Dampiera sp.								x
	Lechenaultia biloba	x	x	x			x		
	Lechenaultia floribunda								x
Haemodoraceae									
	Anigozanthos manglesii						x		
	Anigozanthos viridis								x
	Conostlyis aculeata subsp. *preissii*	x			x				x
	Conostylis serrulata							x	
	Conostylis setigera subsp. *setigera*			x			x		
	Haemodorum laxum	x		x			x	x	
	Haemodorum simplex							x	x
	Haemodorum sp.						x		x
	Hemerocallidaceae	x		x			9	x	x
	Agrostocrinum scabrum			x			x		x
	Caesia micrantha			x			x		
	Dianella revoluta	x							
	Johnsonia pubescens						x		
	Johnsonia pubescens subsp. *?cygnorum*								x
	Tricoryne elatior						x	x	
Iridaceae									
	Freesia alba x leightlinii		x	x					
	Gladiolus caryophyllaceus						x		x
	Patersonia occidentalis			x			x		x
	Patersonia pygmaea	x		x				x	
	Watsonia meriana			x	x	x	x	x	x
Juncaceae									
	Juncus kraussii				x				
Lamiaceae									
	Hemigenia incana	x							
Lauraceae									
	Cassytha racemosa	x		x			x		
Loranthaceae									
	?Nuytsia floribunda			x					
	Nuytsia floribunda	x		x		x	x	x	
Malvaceae									
	Lasiopetalum floribundum	x							
Myrtaceae									
	Calytrix depressa	x							
	Corymbia calophylla	x		x	x	x	x		
	Darwinia thymoides						x		
	Eremaea pauciflora	x							
	Eucalyptus lane-poolei			x					
	Eucalyptus marginata			x			x		
	Eucalyptus sp. (planted)		x						
	Eucalyptus wandoo						x		
	Hypocalymma angustifolium			x			x		
	Kunzea micrantha	x			x			x	x
	Leptospermum laevigatum	x							
	Melaleuca preissiana								x
	Melaleuca viminea	x			x				
	Pericalymma ellipticum	x					x	x	x
	Scholtzia involucrata			x			x		

Family	Species	AfVaLm	AfXpEc	CcAhMt	CcHtCa	CcWmEc	CcXpTo	HtNa	PeCaBs
Myrtaceae	*Verticordia ?densiflora*			x					
	Verticordia acerosa var. *preissii*	x					x	x	
	Verticordia huegelii var. *decumbens*							x	
Orchidaceae									
	Caladenia flava	x					x		
	Microtis media	x					x		
	Microtis media subsp. *media*							x	
	Orchidaceae sp. (sterile)	x					x		x
	Thelymitra graminea	x		x			x		
	Thelymitra vulgaris								x
Oxalidaceae									
	Oxalis pes-caprae	x	x			x	x		x
Papaveraceae									
	Fumaria capreolata					x		x	
Philydraceae									
	Philydrella pygmaea								x
Pittosporaceae									
	Billardiera fraseri	x							
	Billardiera fusiformis			x					
Poaceae									
	Austrostipa compressa			x					
	Avena barbata		x			x		x	x
	Briza maxima	x		x			x	x	x
	Briza minor							x	x
	Ehrharta calycina		x	x		x	x	x	
	Eragrostis curvula		x				x	x	x
	Neurachne alopecuroidea	x		x			x	x	x
	Pentameris airoides						x		
Polygalaceae									
	Comesperma calymega	x							
Primulaceae									
	Lysimachia arvensis						x		x
Proteaceae									
	Adenanthos miesneri						x		x
	Banksia armata							x	
	Banksia dallanneyi			x			x	x	x
	Banksia sessilis						x		
	Banksia squarrosa			x					
	Grevillea bipinnatifida						x		
	Grevillea pilulifera						x		
	Grevillea wilsonii			x			x	x	
	Hakea cyclocarpa			x					
	Hakea divaricata	x							
	Hakea incrassata						x	x	x
	Hakea lissocarpha					x	x		
	Hakea neospathulata			x			x		
	Hakea prostrata								x
	Hakea stenocarpa						x		
	Hakea trifurcata	x			x		x	x	
	Hakea undulata	x							
	Hakea varia								x
	Lambertia multiflora var. *darlingensis*			x					x
	Stirlingia latifolia						x		x
	Synaphea petiolaris subsp. *petiolaris*			x	x		x		
	Hakea ceratophylla						x		
Restionaceae									
	Chaetanthus aristatus	x						x	x
	Desmocladus fasciculatus			x			x		
	Hypolaena exsulca	x					x	x	x
Rhamnaceae									
	Trymalium ledifolium	x							
Rubiaceae									
	Opercularia apiciflora	x					x		
	Opercularia vaginata						x		
Stylidiaceae									
	Levenhookia pusilla	x					x		x
	Stylidium araeophyllum			x					
	Stylidium brunonianum	x		x					
	Stylidium dichotomum	x							
	Stylidium diuroides						x		
	Stylidium diuroides subsp. *diuroides*	x							
	Stylidium emarginatum								x
	Stylidium hispidum	x							
	Stylidium repens			x					
Thymeleaceae									
	Pimelea ciliata subsp. *ciliata*							x	
	Pimelea sp.							x	

Family	Species	AfVaLm	AfXpEc	CcAhMt	CcHtCa	CcWmEc	CcXpTo	HtNa	PeCaBs
Xanthorrhoeaceae									
	Chamaescilla corymbosa			x			x	x	x
	Xanthorrhoea acanthostachya							x	x
	Xanthorrhoea gracilis			x			x		
	Xanthorrhoea preissii		x	x	x		x	x	x

Appendix C

Quadrat Data

Appendix C Quadrat Data

Appendix C Quadrat Data

Site No: Byf01	Type: Releve	Longitude: 116.0021	Latitude: -32.2409
Date: 10/7/2019		Soils: clay gravel	
Topography: drainage		Litter:	
Outcrops: water present		Soil Condition:	
Community: CcWmEc, riparian vegetation		Fire History:	
Vegetation Condition: degraded,			

Taxon	Height (cm)	% Alive
**Avena barbata*	80	5
Corymbia calophylla	1800	20
**Ehrharta calycina*	80	5
**Fumaria capreolata*	20	5
Hakea lissocarpha		0.001
Kennedia prostrata	3	0.1

Taxon	Height (cm)	% Alive
Nuytsia floribunda	400	1
**Oxalis pes-caprae*	10	20
**Watsonia meriana*	50	50

Site No: Byf02	Type: Quadrat	Longitude: 116.0021	Latitude: -32.2402
Date: 10/7/2019		Soils: sand loam gravel	
Topography: flat		Litter: 90% gravel	
Outcrops: laterite		Soil Condition: Dry	
Vegetation Condition: very good,		Fire History: 10+	

Community: CcXpTo, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered),

Taxon	Height (cm)	% Alive
Acacia saligna	40	0.5
Allocasuarina fraseriana	10	0.001
Banksia dallanneyi	16	2
**Briza maxima*	15	0.5
Burchardia congesta	50	0.2
Caesia micrantha	20	2
Corymbia calophylla	400	30
Cyathochaeta avenacea	40	1

Taxon	Height (cm)	% Alive
Dampiera alata	20	0.1
Darwinia thymoides	30	0.1
Drosera macrantha	5	0.1
**Ehrharta calycina*	70	0.5
**Eragrostis curvula*	80	0.5
Gompholobium marginatum	10	0.5
Haemodorum sp.	10	0.2
Hakea stenocarpa	60	1
Hibbertia hypericoides	40	0.001
**Hypochaeris radicata*	1	0.1
Lechenaultia biloba	30	2
Lepidosperma tenue	40	0.5
**Lotus angustissimus*	10	0.5
Mesomelaena tetragona	40	2
Microtis media	15	0.2
Orchidaceae sp. (sterile)	10	0.1
**Oxalis pes-caprae*	10	1
**Pentameris airoides*	10	0.1
Tetraria octandra	20	2
Xanthorrhoea gracilis	40	0.2
Xanthorrhoea preissii	150	8

Site No: byf03	Type: Quadrat	Longitude: 116.0026	Latitude: -32.2387
Date: 10/8/2019		Soils: sand loam gravel	
Topography: flat		Litter: 60%	
Outcrops: none		Soil Condition: Dry	
Vegetation Condition: very good,		Fire History: 10+	

Community: CcXpTo, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered),

Taxon	Height (cm)	% Alive
**Briza maxima*	15	1
Caesia micrantha	20	0.5
Corymbia calophylla	600	35
Darwinia thymoides		0.001
**Eragrostis curvula*	100	4
Grevillea wilsonii		0.001
Haemodorum sp.	10	0.1

Taxon	Height (cm)	% Alive
Hakea lissocarpha		0.001
Kingia australis	250	5
Lepidobolus preissianus		0.001
Lepidosperma pubisquameum	30	5
Lomandra ?caespitosa	20	1
**Lysimachia arvensis*		0.001
Mesomelaena tetragona	4	30
Patersonia occidentalis	20	0.1
Tetraria octandra	20	15
**Watsonia meriana*		0.001
Xanthorrhoea preissii	200	15

Site No: Byf04	Type: Quadrat	Longitude: 116.0030	Latitude: -32.2374
Date: 10/8/2019		Soils: sand loam gravel	
Topography: flat		Litter: 20%	
Outcrops: none		Soil Condition: Dry	
Vegetation Condition: Excellent		Fire History: 10+	

Community: CcXpTo, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered),

Taxon	Height (cm)	% Alive
?Lobelia anceps	15	0.5
Acacia alata	20	0.3
Acacia browniana	10	1
Borya ?scirpoidea	10	0.1
**Briza maxima*	20	1
Caesia micrantha	20	1
Centrolepis aristata	5	0.1

Taxon	Height (cm)	% Alive
Conostylis setigera subsp. *setigera*		0.001
Corymbia calophylla	800	15
Cyathochaeta avenacea	60	0.5
Darwinia thymoides	20	2
Daviesia decurrens		0.001
Desmocladus fasciculatus	20	5
Drosera glanduligera	2	0.1
Drosera macrantha	10	0.1
**Eragrostis curvula*	150	3
Eucalyptus wandoo		0.001
Gastrolobium dilatatum	20	0.2
Gompholobium marginatum	10	0.1
Grevillea bipinnatifida	10	4
Haemodorum laxum	40	0.1
Haemodorum sp.	10	0.2
Hakea incrassata	40	4
Hakea neospathulata	30	1
Hibbertia hypericoides	30	0.2
Hypocalymma angustifolium	50	1
**Hypochaeris glabra*	1	0.5
Hypolaena exsulca	30	2
Lechenaultia biloba	5	0.5
Lepidosperma pubisquameum	30	2
Lomandra preissii	20	0.2
Mesomelaena tetragona	40	20
Neurachne alopecuroidea	20	0.5
Pericalymma ellipticum		0.001
Schoenus grandiflorus	40	0.5
Scholtzia involucrata	40	1
Synaphea petiolaris subsp. *petiolaris*	40	1
Tetraria octandra	20	30
Tetratheca hirsuta subsp. *hirsuta*	5	0.1
Thelymitra graminea	15	0.1
Thysanotus manglesianus / patersonia complex		0.1
Thysanotus multiflorus	20	0.2
**Watsonia meriana*	10	0.1
Xanthorrhoea preissii	150	6

Site No: Byf05	Type: Quadrat	Longitude: 116.0035	Latitude: -32.2361
Date: 10/8/2019		Soils: clay	
Topography: low lying		Litter: 5%	
Outcrops: none		Soil Condition: Waterlogged	
Vegetation Condition: very good to good, weeds		Fire History:	

Community: PeCaBs, Likely to represent Claypans of the Swan Coastal Plain (EPBC Critically Endangered) and may represent WA TEC Herb rich shrublands in claypans (FCT8). Likely to be a GDE.

Taxon	Height (cm)	% Alive
Acacia browniana	30	0.5
**Avena barbata*	50	1
Borya ?scirpoidea	10	2
**Briza maxima*	20	10
**Briza minor*	10	0.5
Chaetanthus aristatus	60	10
Chamaescilla corymbosa	2	0.1

Taxon	Height (cm)	% Alive
Conostylis aculeata subsp. *preissii*	20	1
Cyathochaeta avenacea	80	3
Drosera micrantha	15	0.2
**Eragrostis curvula*	120	2
**Hypochaeris glabra*	1	0.1
Hypolaena exsulca	70	10
Isolepis cernua	4	0.1
Kunzea micrantha	50	1
Lechenaultia floribunda	30	0.3
**Lysimachia arvensis*	5	0.5
Melaleuca preissiana		0.001
Mesomelaena tetragona	50	3
**Oxalis pes-caprae*	2	0.1
Patersonia occidentalis	30	0.1
Pericalymma ellipticum	100	4
Siloxerus filifolius	1	0.1
**Ursinia anthemoides*	10	0.5
**Watsonia meriana*	40	6
Thelymitra vulgaris	20	0.1
Xanthorrhoea preissii	150	3

Site No: Byf06	Type: Quadrat	Longitude: 116.0040	Latitude: -32.2341
Date: 10/8/2019		Soils: clay	
Topography: winter wet		Litter: 5%	
Outcrops: none		Soil Condition: Waterlogged	
Vegetation Condition: very good		Fire History: 10+	

Community: PeCaBs, Likely to represent Claypans of the Swan Coastal Plain (EPBC Critically Endangered) and may represent WA TEC Herb rich shrublands in claypans (FCT8). Likely to be a GDE.

Taxon	Height (cm)	% Alive
Anigozanthos viridis	40	0.1
Banksia dallanneyi	20	5
Borya ?scirpoidea	5	6
Chaetanthus aristatus	50	5
Chamaescilla corymbosa	5	0.1
**Cicendia filiformis*	2	0.1
Dampiera linearis	20	0.2
Dampiera sp.	15	0.1

Taxon	Height (cm)	% Alive
Dasypogon bromeliifolius	20	1
Drosera gigantea		0.001
Drosera glanduligera	5	0.1
Drosera marchantii	10	0.5
**Gladiolus caryophyllaceus*	5	0.1
Haemodorum simplex		0.001
Haemodorum sp.	20	0.1
Hakea incrassata	20	0.5
Hakea prostrata	40	1
Hakea varia	200	5
**Hypochaeris glabra*	1	0.5
Hypolaena exsulca	40	4
Hypolaena exsulca	10	0.2
Isolepis cernua	5	0.1
Levenhookia pusilla	1	0.1
Lomandra micrantha	20	1
Mesomelaena tetragona	50	6
Neurachne alopecuroidea	30	1
Orchidaceae sp. (sterile)	15	0.1
Pericalymma ellipticum	80	3
Philydrella pygmaea		0.001
Schoenus clandestinus	5	0.5
Schoenus efoliatus	30	5
Stirlingia latifolia	40	3
Stylidium emarginatum		0.001
Thysanotus multiflorus	20	0.5
Tricostularia neesii	20	2
Viminaria juncea	500	0.001
**Watsonia meriana*	60	18
Xanthorrhoea acanthostachya	80	8
Adenanthos meisneri		0.001
Agrostocrinum scabrum		0.001
Johnsonia pubescens		0.001
Lambertia multiflora var. darlingensis		0.001

Site No: Byf07	Type: Quadrat	Longitude: 116.0052	Latitude: -32.2337
Date: 10/8/2019		Soils: sandy	
Topography: lower slope		Litter: 5% litter	
Outcrops: limestone small and medium size		Soil Condition: Moist	
Community: AfVaLm		Fire History: 10+	
Vegetation Condition: excellent			

Taxon	Height (cm)	% Alive
Acacia pulchella var. *glaberrima*	60	1
Allocasuarina fraseriana	500	2
Astroloma pallidum	15	0.3
Borya ?scirpoidea	5	0.5
Cassytha racemosa		0.1
Chaetanthus aristatus	40	2
Conostylis aculeata subsp. *preissii*	20	2
Cyathochaeta avenacea	40	4
Dampiera linearis	15	0.5

Taxon	Height (cm)	% Alive
Dasypogon bromeliifolius	15	0.5
Dianella revoluta	20	0.5
Drosera marchantii	3	0.1
Gompholobium marginatum	10	0.3
Hakea divaricata	200	1.5
Hakea divaricata	50	0.001
Hakea undulata	150	1
Hemigenia incana	20	1
**Hypochaeris glabra*	1	0.5
Hypolaena exsulca	20	1
Isolepis cernua	2	0.1
Lasiopetalum floribundum	20	1
Levenhookia pusilla	2	0.1
Lomandra drummondii	30	0.5
Lomandra micrantha	20	7
Melaleuca viminea	20	0.5
Mesomelaena tetragona	50	7
Microtis media	10	0.1
Neurachne alopecuroidea	20	5
Opercularia apiciflora	15	0.2
Orchidaceae sp. (sterile)	15	0.1
**Oxalis pes-caprae*	3	0.1
Patersonia pygmaea	15	0.5
Pericalymma ellipticum	40	1
Stylidium brunonianum	5	0.5
Stylidium dichotomum	5	2
Stylidium hispidum	5	0.1
Thysanotus multiflorus	5	0.1
Trymalium ledifolium	20	0.2
Verticordia acerosa var. *preissii*	40	4
Thelymitra graminea	20	0.1
Xanthosia candida	5	0.1

Site No: Byf08	Type: quadrat	Longitude: 116.0054	Latitude: -32.2322
Date: 10/8/2019		Soils: gravel	
Topography: lower slope		Litter: 4%	
Outcrops: laterite		Soil Condition: Dry	
Community: AfVaLm		Fire History: 10+	
Vegetation Condition: very good, historically cleared and contoured			

Taxon	Height (cm)	% Alive
Acacia lateriticola	20	1
Acacia pulchella var. *glaberrima*	30	1
Billardiera fraseri	20	0.5
**Briza maxima*		0.001
Caladenia flava	5	0.1
Calytrix depressa	80	0.2
Chaetanthus aristatus		0.001
Comesperma calymega	20	0.1

Taxon	Height (cm)	% Alive
Corymbia calophylla	200	1
Daviesia triflora	20	0.2
Drosera marchantii	10	0.2
Eremaea pauciflora	20	2
Haemodorum laxum		0.001
Hakea trifurcata	300	3
Hakea undulata	20	0.3
Kunzea micrantha	150	0.5
Lechenaultia biloba	20	0.5
**Leptospermum laevigatum*	200	4
Lomandra drummondii	20	0.1
Mesomelaena tetragona	40	17
Nuytsia floribunda		0.001
Pericalymma ellipticum	20	0.2
Stylidium diuroides subsp. *diuroides*	5	4
Verticordia acerosa var. *preissii*	30	10

Site No: Byf09	Type: Releve	Longitude: 116.0055	Latitude: -32.2314
Date: 10/8/2019		Soils: gravel	
Topography: lower slope to wetland		Litter: 60% litter	
Outcrops: laterite rocks		Soil Condition: Dry	
Community: CcHtCa ?GDE		Fire History: 10+	
Vegetation Condition: very good, watsonia			

Taxon	Height (cm)	% Alive
Acacia pulchella var. *glaberrima*	50	0.5
**Acacia sp. (planted)*	200	1
Conostylis aculeata subsp. *preissii*	20	1
Corymbia calophylla	800	25
Cyathochaeta avenacea	40	20
Hakea trifurcata	350	30
Juncus kraussii		0.001
Kunzea micrantha	300	15
Lepidosperma leptostachyum		0.001

Taxon	Height (cm)	% Alive
Melaleuca viminea	100	0.2
Mesomelaena tetragona	40	25
Synaphea petiolaris subsp. *petiolaris*	30	0.5
Viminaria juncea	200	1
**Watsonia meriana*	60	5
Xanthorrhoea preissii	150	0.2
**Zantedeschia aethiopica*		0.001

Site No: Byf10	Type: Quadrat	Longitude: 116.0068	Latitude: -32.2270
Date: 10/8/2019		Soils: loam brown	
Topography: slope to flat		Litter: 20%	
Outcrops: none		Soil Condition: Moist	
Vegetation Condition: good to very good, watsonia		Fire History: 10+	

Community: CcXpTo, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered),

Taxon	Height (cm)	% Alive
Acacia lateriticola	20	0.5
Acacia pulchella var. glaberrima	60	1
Allocasuarina humilis	150	4
Banksia dallanneyi	10	3
**Briza maxima*		0.001
Burchardia congesta	30	0.1
Caesia micrantha	30	0.5

Taxon	Height (cm)	% Alive
Corymbia calophylla	1800	35
Dampiera linearis	10	0.1
Desmocladus fasciculatus	10	0.2
**Gladiolus caryophyllaceus*	20	0.1
Grevillea bipinnatifida	10	0.5
Grevillea pilulifera	30	0.2
Hakea trifurcata	200	2
Hakea ceratophylla	140	4
Hypocalymma angustifolium	30	0.2
Hypolaena exsulca	30	0.2
Lechenaultia biloba	30	1
Lomandra drummondii	30	0.1
Mesomelaena tetragona	50	10
Neurachne alopecuroidea	20	7
Opercularia apiciflora	30	4
Patersonia occidentalis		0.001
Stirlingia latifolia	60	2
Synaphea petiolaris subsp. petiolaris	20	1
Tetraria octandra	30	15
Viminaria juncea	200	2
**Watsonia meriana*	50	4
Xanthorrhoea preissii	140	30

Site No: Byf12	Type: Releve	Longitude: 116.0108	Latitude: -32.1625
Date: 10/8/2019		Soils: gravel	
Topography: flat		Litter: 20%	
Outcrops: none		Soil Condition: Dry	
Community: AfXpEc		Fire History: 10+	
Vegetation Condition: degraded,			

Taxon	Height (cm)	% Alive
**Acacia* sp. (planted)	600	3
Allocasuarina fraseriana	500	1
**Avena barbata*	60	2
**Ehrharta calycina*	70	10
**Eragrostis curvula*	60	3
**Eucalyptus sp. (planted)*	700	5
**Freesia alba x leightlinii*	10	20
Lechenaultia biloba	40	1
Lepidosperma leptostachyum	40	1

Taxon	Height (cm)	% Alive
**Lotus angustissimus*	5	1
**Oxalis pes-caprae*	20	1
Xanthorrhoea preissii	200	30

Site No: Byf13	Type: Quadrat	Longitude: 116.0044	Latitude: -32.2327
Date: 10/8/2019		Soils: sand grey	
Topography: flat		Litter: 50%	
Outcrops: none		Soil Condition: Dry	
Vegetation Condition: Excellent		Fire History: 10+	

Community: CcXpTo, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered) and/or *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands (SCP3c) (EPBC Endangered, WA Critically Endangered),

Taxon	Height (cm)	% Alive
?Lobelia anceps	20	0.2
Acacia lateriticola	20	2
Acacia pulchella var. *glaberrima*	80	1
Adenanthos meisneri	5	0.1
Agrostocrinum scabrum	40	0.5
Anigozanthos manglesii	40	0.2
Banksia dallanneyi	15	2

Taxon	Height (cm)	% Alive
Banksia sessilis		0.001
Borya ?scirpoidea	5	1
**Briza maxima*	20	1
Caesia micrantha	40	0.2
Caladenia flava	5	0.1
Calectasia grandiflora	20	0.5
Cassytha racemosa		0.1
Chamaescilla corymbosa	10	0.1
Conostylis setigera subsp. *setigera*	5	0.5
Corymbia calophylla	1500	8
Dampiera linearis	15	0.1
Dasypogon bromeliifolius	30	8
Daviesia preissii	20	1.5
Daviesia triflora	30	1
Desmocladus fasciculatus	10	1
Drosera porrecta	10	0.5
**Ehrharta calycina*	100	0.1
Eucalyptus marginata	1500	0.001
Haemodorum laxum		0.001
Hakea trifurcata	200	2
Hovea trisperma	10	0.1
Hypolaena exsulca	20	0.1
Johnsonia pubescens	10	0.2
Kingia australis	50	1
Lechenaultia biloba	20	0.5
Lepidosperma pubisquameum	30	2
Lomandra drummondii	20	1
Lomandra hermaphrodita	10	0.1
Lomandra micrantha	10	3
Mesomelaena tetragona	40	10
Neurachne alopecuroidea	30	3
Opercularia apiciflora	20	1
Opercularia vaginata	20	2
Pericalymma ellipticum	60	0.5
Schoenus pedicellatus	20	0.2
Stirlingia latifolia	10	0.5
Stylidium diuroides	10	0.1

Taxon	Height (cm)	% Alive
Tetraria octandra	30	25
Thysanotus multiflorus	15	0.1
**Ursinia anthemoides*	10	0.1
Verticordia acerosa var. *preissii*		0.001
Thelymitra graminea	30	0.1
Xanthorrhoea gracilis	50	3
Xanthorrhoea preissii	150	25

Site No: Byf14	Type: Releve	Longitude: 116.0048	Latitude: -32.2313
Date: 10/9/2019		Soils: clay	
Topography: winter wet		Litter: low	
Outcrops: none		Soil Condition: Waterlogged	
Community: HtNa, GDE		Fire History: 10+	
Vegetation Condition: Excellent			

Taxon	Height (cm)	% Alive
Aphelia cyperoides	2	15
Chaetanthus aristatus	50	30
Drosera sp.	5	0.5
Hakea trifurcata	200	50
Hypolaena exsulca	40	10
Isolepis cernua	5	0.5
Kingia australis	400	5
Kunzea micrantha	200	15
Patersonia pygmaea	20	1

Taxon	Height (cm)	% Alive
Pericalymma ellipticum	50	5
**Watsonia meriana*	30	1

Site No: Byf15	Type: Quadrat	Longitude: 116.0056	Latitude: -32.2294
Date: 10/9/2019		Soils: gravel	
Topography: flat		Litter:	
Outcrops: none		Soil Condition: Dry	
Community: HtNa, GDE		Fire History: 10+	
Vegetation Condition: very good, historically cleared, ground contoured			

Taxon	Height (cm)	% Alive
Acacia lateriticola	30	0.1
**Avena barbata*	80	0.5
Borya ?scirpoidea	10	50
**Briza maxima*	10	5
**Briza minor*	10	0.5
Chamaescilla corymbosa	5	5
Dampiera linearis	10	0.1
Drosera erythrorhiza	1	0.1
Drosera marchantii	10	0.1

Taxon	Height (cm)	% Alive
**Eragrostis curvula*	80	1
**Fumaria capreolata*	20	0.2
Haemodorum simplex	30	3
Hakea trifurcata	130	4
**Hypochaeris radicata*	1	0.1
Neurachne alopecuroidea	30	10
Pimelea ciliata subsp. ciliata	20	0.2
Ptilotus manglesii		0.001
Thysanotus multiflorus	10	0.1
Verticordia acerosa var. preissii	30	10
Verticordia huegelii var. decumbens	30	5
**Watsonia meriana*	40	2
Xanthorrhoea preissii	110	6

Site No: byf15	Type: Quadrat	Longitude: 116.0083	Latitude: -32.1785
Date: 10/9/2019		Soils: sandy grey	
Topography: flat		Litter: 35%	
Outcrops: none		Soil Condition: Dry	
Vegetation Condition: excellent,		Fire History: 10+	

Community: CcAhMt, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered)

Community: CcAhMt Fire History: 10+

Taxon	Height (cm)	% Alive
?Nuytsia floribunda	10	0.1
Acacia sp.	15	0.1
Agrostocrinum scabrum		0.001
Allocasuarina humilis	100	8
Banksia dallanneyi	20	5
Banksia squarrosa	50	1
Billardiera fusiformis		0.001

Taxon	Height (cm)	% Alive
Borya ?scirpoidea	5	1
**Briza maxima*		0.001
Burchardia congesta	40	0.1
Caesia micrantha	20	0.1
Chamaescilla corymbosa	5	0.5
Conostylis setigera subsp. *setigera*	5	1
Corymbia calophylla	2000	6
Cyathochaeta avenacea		0.001
Daviesia decurrens	30	1.5
Desmocladus fasciculatus	10	3
Drosera porrecta	10	0.5
Eucalyptus lane-poolei		0.001
Eucalyptus marginata	800	0.001
**Freesia alba x leightlinii*	10	0.1
Gastrolobium spathulatum	20	0.2
Gompholobium marginatum	10	1
Grevillea wilsonii	40	5
Haemodorum laxum	50	0.1
Hakea cyclocarpa	30	0.5
Hakea neospathulata	30	4
Hibbertia hypericoides	30	6
Hovea trisperma	10	0.1
Hypocalymma angustifolium	80	2
Kingia australis	250	1
Lambertia multiflora var. *darlingensis*	50	0.001
Lechenaultia biloba	20	0.2
Lepidosperma sp.	20	0.5
Lomandra caespitosa	30	1
Lomandra drummondii	20	1
Mesomelaena tetragona	40	5
Neurachne alopecuroidea	30	0.5
Patersonia occidentalis	20	0.5
Patersonia pygmaea	15	0.1
Pterochaeta paniculata	5	0.1
Schoenus clandestinus	5	0.2
Scholtzia involucrata	20	0.1
Sphaerolobium medium	30	0.2

Taxon	Height (cm)	% Alive
Stylidium brunonianum	10	0.1
Tetraria octandra	20	6
Thysanotus triandrus	10	0.2
Trachymene pilosa	5	0.1
**Ursinia anthemoides*	15	0.1
Verticordia ?densiflora	25	1
Thelymitra graminea	20	0.2
Xanthorrhoea preissii	100	14

Site No: Byf16	Type: Quadrat	Longitude: 116.0084	Latitude: -32.1818
Date: 10/9/2019		Soils: gravel loam	
Topography: flat		Litter: 20%	
Outcrops: none		Soil Condition: Dry	
Vegetation Condition: excellent,		Fire History: 10+	

Community: CcAhMt, Represents *Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (SCP3a) (EPBC Endangered, WA Critically Endangered)

Taxon	Height (cm)	% Alive
?Nuytsia floribunda	10	0.1
Agrostocrinum scabrum		0.001
Allocasuarina humilis	130	2
Austrostipa compressa		0.001
Banksia dallanneyi	10	3
Banksia squarrosa		0.001
Borya ?scirpoidea	5	8
**Briza maxima*	20	1
Caesia micrantha	15	0.1

Taxon	Height (cm)	% Alive
Cassytha racemosa	0	0.1
Conostylis setigera subsp. *setigera*	5	0.5
Corymbia calophylla	1000	10
Cyathochaeta avenacea	30	2
Daviesia decurrens	30	1
Desmocladus fasciculatus	5	4
Drosera marchantii	10	0.1
Drosera porrecta	10	0.5
**Ehrharta calycina*	100	0.2
Eucalyptus lane-poolei		0.001
Gastrolobium spathulatum	20	0.1
Gompholobium marginatum	5	1
Grevillea wilsonii	20	0.5
Hakea cyclocarpa	40	1
Hibbertia hypericoides	30	3
Hovea trisperma	20	0.1
Kingia australis	100	1
Lechenaultia biloba	20	0.2
Lepidosperma leptostachyum	20	1
Lomandra drummondii	30	1
Mesomelaena stygia subsp. *stygia*	20	3
Mesomelaena tetragona	40	10
Neurachne alopecuroidea	10	0.5
Nuytsia floribunda	500	5
Patersonia occidentalis	40	0.5
Schoenus clandestinus	5	5
Scholtzia involucrata		0.001
Stylidium araeophyllum	10	0.2
Stylidium repens	5	0.1
Synaphea petiolaris subsp. *petiolaris*	30	0.5
Tetraria octandra	20	4
**Ursinia anthemoides*	10	0.1
Verticordia ?densiflora	20	0.3
**Watsonia meriana*	30	0.5
Xanthorrhoea gracilis	50	1
Xanthorrhoea preissii	150	15

Site No: Byf17	Type: Releve	Longitude: 116.0089	Latitude: -32.1798
Date: 10/9/2019		Soils: gravel loam	
Topography: mid slope		Litter: 25% leaves	
Outcrops:		Soil Condition: Dry	
Vegetation Condition: very good, partial clearing, some weeds.		Fire History: 10+	
Community: CcXpTo			

Taxon	Height (cm)	% Alive
Acacia lateriticola	20	2
Banksia dallanneyi	15	2
Borya ?scirpoidea	5	4
**Briza maxima*	10	1
Cassytha racemosa		0.1
Conostylis setigera subsp. *setigera*	5	2
Corymbia calophylla	1200	10
Cyathochaeta avenacea	30	4
Dasypogon bromeliifolius	15	2

Taxon	Height (cm)	% Alive
Desmocladus fasciculatus	5	0.5
**Ehrharta calycina*	80	1
**Eragrostis curvula*	100	0.5
Gompholobium marginatum	10	0.1
Grevillea wilsonii	50	0.5
Hakea incrassata	30	1
Hibbertia hypericoides	30	1
Hovea trisperma	15	0.2
Hypolaena exsulca	30	2
Labichea punctata	20	0.3
Laxmannia squarrosa	5	0.2
Lechenaultia biloba	30	0.1
Levenhookia pusilla	3	0.1
Lomandra hermaphrodita	20	0.1
Lomandra micrantha	20	0.1
Mesomelaena tetragona	50	15
Schoenus sp.	10	0.5
Stirlingia latifolia	80	6
Synaphea petiolaris subsp. *petiolaris*	20	0.5
Tetraria octandra	30	6
Tricoryne elatior	30	0.5
**Ursinia anthemoides*	5	0.1
**Watsonia meriana*	40	1
Xanthorrhoea preissii	150	8

Site No: Byf18	Type: Releve	Longitude: 116.0089	Latitude: -32.1798
Date: 10/9/2019		Soils: gravel loam	
Topography: mid slope		Litter: 70% leaves	
Outcrops:		Soil Condition: Dry	
Vegetation Condition: good,		Fire History: 10+	
Community: CcXpTo			

Taxon	Height (cm)	% Alive
Allocasuarina humilis	150	0.001
**Briza maxima*	15	0.5
Chamaescilla corymbosa	5	0.1
Conostylis setigera subsp. *setigera*	10	0.001
Corymbia calophylla	1200	30
Cyathochaeta avenacea	30	15
Desmocladus fasciculatus	5	0.2
**Ehrharta calycina*	50	3
Grevillea wilsonii	40	0.2

Taxon	Height (cm)	% Alive
Kingia australis	300	1
Lechenaultia biloba	10	0.001
Lomandra hermaphrodita	10	0.001
Mesomelaena tetragona	30	1
Neurachne alopecuroidea	20	0.5
Nuytsia floribunda		0.001
Tetraria octandra	20	3
Tricoryne elatior	20	0.001
**Watsonia meriana*	30	0.001
Xanthorrhoea preissii	200	5

Site No: Byf19	Type: Releve	Longitude: 116.0072	Latitude: -32.2085
Date: 11/19/2019		Soils: gravel	
Topography: mid slope		Litter: low	
Outcrops:		Soil Condition: Dry	
Community: HtNa, GDE		Fire History: 10+	
Vegetation Condition: good, weeds, clearing, rubbish			

Taxon	Height (cm)	% Alive
Acacia lateriticola		0.001
**Avena barbata*		0.001
Banksia armata	30	5
Banksia dallanneyi	15	2
Borya ?scirpoidea	5	8
**Briza maxima*		0.001
Conostylis serrulata		0.001
**Ehrharta calycina*	100	1

Taxon	Height (cm)	% Alive
**Eragrostis curvula*	100	1
Grevillea wilsonii	20	1
Haemodorum laxum		0.001
Hakea incrassata	50	0.5
Hakea trifurcata	250	15
Laxmannia squarrosa		0.001
Lomandra drummondii	20	2
Lomandra micrantha	20	2
Lomandra sonderi	20	0.5
Mesomelaena stygia subsp. *stygia*	20	0.2
Microtis media subsp. media		0.001
Nuytsia floribunda		0.001
Pimelea sp.		0.001
Tricoryne elatior	20	0.1
**Ursinia anthemoides*	5	0.5
Xanthorrhoea acanthostachya		0.001
Xanthorrhoea preissii	130	10

Appendix D

Black Cockatoo Breeding Habitat Data

Appendix D Black Cockatoo Breeding Habitat Data

Species	Tree Height (m)	DBH (cm)	Comments	Hollows Assessment Issues	No. of Potentially Suitable Hollows	New ID
Marri	700	70			0	269
Marri	14	55			0	272
Marri	12	85			0	271
Marri	12	55			0	270
Marri	14	50			0	268
Wandoo	12	85			0	267
Marri	15	65			0	266
Marri	14	60			0	265
FloodedGum	14	65			0	264
Marri	12	58			0	279
Marri	12	65			0	280
Marri	12	54			0	311
Marri	15	55			0	312
Stag	15	52			0	313
Wandoo	17	52			0	315
Wandoo	15	31			0	317
Wandoo	13	31			0	319
Marri	20	51			0	321
Marri	22	63			0	322
Marri	25	85			0	323
Wandoo	12	60			0	324
Marri	20	70			0	325
Marri	25	80			0	326
FloodedGum	17	60			0	327
FloodedGum	25	100			0	329
Marri	27	75			0	330
Marri	20	58			0	332
Marri	25	60			0	334
Marri	16	65			0	336
Marri	22	80			0	337
Marri	20	65			0	338
Marri	20	52			0	339
Marri	30	120			0	340
Marri	18	70			0	341
Jarrah	30	100			0	342
Marri	16	55			0	344
Marri	14	80			0	348
Marri	18	55			0	347
Wandoo	12	70			0	346
FloodedGum	6	90			0	345
FloodedGum	18	120			0	343
Marri	18	70			0	335
Marri	18	80			0	333
Marri	18	160			0	331
Marri	16	60			0	328
Marri	16	52			0	320
Marri	14	52			0	318
Marri	14	50			0	316
Marri	18	90			0	314
Marri	22	110			0	310
Stag	14	70			0	309
Marri	18	85			0	308
Marri	18	70			0	307
Marri	14	52			0	306

Marri	12	52			0	305
Marri	18	65			0	304
Marri	15	50		confirmed	0	303
Marri	14	55			0	302
Marri	16	52			0	301
Marri	14	52			0	300
Stag	18	120			0	299
Marri	16	60			0	298
Marri	12	180			0	297
Marri	17	65			0	296
Marri	16	60			0	295
Marri	16	60			0	294
Marri	16	55			0	293
Marri	18	55			0	292
Marri	17	50			0	291
Marri	10	90			0	290
Marri	12	60	Multiple trunks		0	289
Marri	18	55			0	288
Marri	10	75			0	287
Marri	15	110			0	286
Marri	14	60			0	285
Marri	14	65			0	284
Marri	14	55			0	283
Marri	12	110			0	282
Marri	15	90			0	281
Marri	8	55			0	278
Marri	10	55			0	277
Marri	8	55			0	276
Marri	12	55			0	275
Marri	10	55			0	274
Stag	10	70			0	273
Jarrah	18	70			0	349
Marri	15	54			0	350
Marri	20	62			0	356
Jarrah	15	70			0	357
Stag	5	70			0	358
Marri	10	75			0	364
Marri	18	70			0	365
Marri	16	60			0	366
Marri	18	90			0	367
Marri	15	60			0	371
Stag	12	80	European Honeybee utilising tree	confirmed		373
Marri	13	52			0	375
FloodedGum	15	50			0	376
Marri	18	52			0	377
Marri	13	52			0	378
Marri	20	72			0	380
Marri	9	85	Vertical spout hollow 40 cm x 40 cm, 6 m high, facing up, looks deep with suitable chamber		1	384
Jarrah	14	80			0	388
Marri	18	80			0	389
Marri	22	75			0	390
Marri	18	53			0	400
Marri	16	65			0	401
Marri	14	51			0	402

Marri	14	57			0	403
FloodedGum	15	140			0	404
Marri	14	52			0	398
Marri	14	65			0	397
Marri	14	60			0	396
Marri	15	60			0	395
Marri	15	55			0	394
Marri	12	55			0	393
Marri	18	110			0	392
Marri	10	52			0	391
Stag	10	52			0	387
Marri	17	100			0	386
Marri	20	90			0	385
Marri	17	140			0	383
Marri	17	60			0	382
Marri	20	60			0	381
Marri	16	50			0	379
Stag	10	100	45 degrees branch hollow 20 cm x 15 cm, 6 m high, facing NW. Bees utlising. No chew / claw marks.		1	374
Marri	12	52			0	372
Marri	16	140			0	370
Marri	18	50			0	369
Marri	18	55			0	363
Marri	22	55			0	362
Marri	20	50			0	361
Marri	18	65			0	360
Marri	12	65			0	359
Marri	20	85			0	355
Marri	16	60			0	354
Marri	17	52			0	353
Marri	18	70			0	352
Marri	17	55			0	351
FloodedGum	18	55			0	405
FloodedGum	18	60			0	406
Marri	18	52			0	407
Marri	18	50	Multiple trunks		0	408
Marri	18	70	Forks directly above chest height		0	409
Marri	16	50			0	410
Marri	22	90	On border of private property, couldn't assess fully	confirmed	0	411
Marri	18	55			0	412
Marri	16	70			0	413
Marri	16	55			0	414
Marri	12	55			0	415
Marri	14	50			0	416
Marri	14	50			0	417
Marri	12	60	Tree forks just above dbh		0	418
Stag	12	50	Could not access tree due to fence but may have suitable hollows	confirmed		419
FloodedGum	15	85			0	429
Marri	16	55			0	428
Marri	15	62			0	0
Marri	20	75			0	427
Marri	16	62			0	426

FloodedGum	20	70			0	425
FloodedGum	20	85			0	424
FloodedGum	18	90			0	423
FloodedGum	12	55			0	422
FloodedGum	18	60			0	421
FloodedGum	22	65			0	420
FloodedGum	16	100			0	430
Marri	10	50			0	431
Marri	15	70			0	432
Marri	16	52			0	433
Marri	16	54			0	434
Marri	18	54	Forks just above dbh		0	435
Marri	18	50			0	436
Marri	15	50			0	437
Marri	12	55			0	438
Marri	15	50			0	439
Marri	12	50			0	440
Marri	14	78			0	441
Marri	16	57			0	442
FloodedGum	16	75			0	443
Marri	12	50			0	444
FloodedGum	18	72			0	445
Marri	12	60			0	446
Marri	17	57			0	578
Marri	18	73			0	576
Marri	16	73		confirmed		575
Stag	16	56		confirmed		574
Marri	24	61			0	573
Marri	18	66			0	548
Marri	18	63			0	571
Marri	14	59			0	545
Marri	16	60			0	544
Marri	20	51			0	569
Marri	20	73			0	567
Marri	16	71			0	565
Introduced	20	75			0	542
Marri	14	62		confirmed		564
Marri	14	51		confirmed		562
FloodedGum	25	80	Horizontal spout hollow 15 cm x 15 cm, 6 m high. No chew/ claw marks. Bees present.	confirmed	1	538
Marri	15	70	1: Vertical spout hollow 10 cm x 10 cm, 12 m high, facing down. No claw / chew marks. H2: Vertical spout hollow 10 cm x 10 cm, 12 m above ground. 3: Horizontal trunk hollow 30 cm x 30 cm, 12 m above ground. No chew / claw marks. Bees utilising.		3	559
Marri	14	56			0	556
FloodedGum	30	70	Multiple trunks, small hollows		0	536
Marri	10	51			0	555
Introduced	22	84			0	554
FloodedGum	15	65	Unable to access due to drainage line and black berry infestation. Estimated.	confirmed		535
FloodedGum	16	53			0	553

FloodedGum	12	53	Multiple trunks		0	552
FloodedGum	20	65	Unable to access or see clearly to check for hollows. Black berry infestation	confirmed		533
Marri	15	70			0	547
FloodedGum	25	75			0	532
Marri	16	50			0	546
Marri	14	52			0	543
Marri	15	62			0	541
FloodedGum	25	65			0	528
FloodedGum	18	65			0	539
FloodedGum	17	70			0	537
FloodedGum	18	60	Access restricted by blackberry		0	534
FloodedGum	18	70			0	531
FloodedGum	35	86	Multiple trunks. 10x10 17 Horizontal branch hollow 10 cm x 10 cm, 17 above ground. No chew / claw marks. Bees utilising		1	530
Marri	23	50			0	529
FloodedGum	27	52	Lots of small hollows		0	525
FloodedGum	30	66	Hollow too shallow.		0	527
FloodedGum	35	90	Multiple trunks	confirmed		540
FloodedGum	35	120	Lots of small hollows - not wide enough. Horizontal spout hollow 10 cm x 10 cm, 20 m above ground. No claw / chew marks.		1	524
FloodedGum	15	50	Horizontal spout hollow 10 cm x 10 cm, 2 m above ground. No claw / chew marks.		1	523
FloodedGum	30	75			0	522
FloodedGum	25	85			0	516
FloodedGum	35	80			0	519
FloodedGum	35	101			0	517
Marri	17	63			0	520
FloodedGum	25	113	10x10 3 Vertical branch hollow 10 cm x 10 cm, 3 above ground, facing NW. No claw / chew marks.		1	515
FloodedGum	22	69	Multiple trunks		0	514
Marri	15	60			0	511
Introduced	22	70	Private property. Unable to access	confirmed		508
Introduced	23	70	Private property. Unable to access	confirmed		507
Introduced	20	70	Private property. Unable to access	confirmed		505
Introduced	19	50	Private property. Unable to access	confirmed		504
Introduced	23	75	Private property. Unable to access	confirmed		503
Introduced	22	85	Private property. Unable to access	confirmed		502
Introduced	15	55	Private property. Unable to access	confirmed		501
Introduced	16	60	Private property. Unable to access	confirmed		499

Marri	15	75	Private property. Unable to access	confirmed		498
Marri	20	65	Multiple trunks		0	495
Marri	18	63			0	494
Marri	22	83			0	493
Marri	24	63	One hollow, too small.		0	492
Marri	18	55			0	490
Marri	13	54			0	482
Marri	20	60	Iron bark. 10x10 3 Vertical trunk hollow 10 cm x 10 cm, 3 m above ground. No chew / claw marks. Unable to assess further due to position - potentially additonal hollows.	confirmed	1	484
Marri	25	93	10x10 3 45 degree trunk hollow 10 cm x 10 cm, 3 m above ground, facing SW. Potentially additonal hollows.	confirmed	1	485
FloodedGum	25	140			0	487
Marri	16	57	Multiple trunks		0	488
Marri	18	70	Two trunks. Estimated from outside boundary	confirmed		489
FloodedGum	27	93			0	481
Marri	16	50			0	480
Marri	18	63			0	478
Introduced	14	79			0	477
Introduced	15	63			0	476
Introduced	16	61			0	475
Introduced	10	107	Multiple spouts		0	474
Marri	13	67			0	473
Introduced	18	76			0	472
Introduced	15	60			0	471
Introduced	18	51			0	470
FloodedGum	25	53	Two trunks		0	0
FloodedGum	24	53	Multiple branches		0	468
Introduced	9	60	Iron bark		0	467
Introduced	16	58			0	466
Introduced	13	51			0	465
Introduced	13	55			0	464
FloodedGum	10	55			0	463
Introduced	15	57			0	462
Introduced	15	57			0	461
Introduced	12	55	Iron bark. Tree splits in two approx 1m up		0	460
Introduced	15	76	Iron bark		0	459
Introduced	10	56	Iron bark		0	458
Introduced	13	53			0	451
Introduced	15	63			0	452
Introduced	11	62			0	453
Introduced	12	56			0	455
Introduced	12	57		confirmed		456
Introduced	20	65			0	457
Introduced	10	53			0	454
FloodedGum	14	51			0	450
FloodedGum	14	50			0	449
Marri	17	62			0	448
Marri	16	85			0	447
Marri	18	70			0	579

Wandoo	20	59			0	577
Marri	16	55			0	572
Introduced	19	80			0	570
Marri	15	50			0	568
Marri	17	59			0	566
Marri	19	58			0	563
Marri	20	51			0	561
Marri	16	72			0	560
Marri	17	53			0	557
FloodedGum	20	80			0	551
Introduced	14	63			0	550
Introduced	13	65			0	549
FloodedGum	20	80	across creek cannot access to measure		0	521
Tuart	20	53			0	518
Marri	16	60			0	513
Marri	10	55	Tree bent over with termite nest at base		0	512
Marri	16	53			0	510
Marri	15	55			0	509
Marri	23	90	Private property. Unable to access	confirmed		506
Marri	16	70			0	500
Marri	17	50			0	497
Marri	18	56			0	496
Marri	20	90	On other side of regional park fence. H1: 45 degree spout hollow 15 cm x 15 cm, 12 m high, facing SW, old chew / claw markings potentially present. H2: 45 Degree spout hollow 15 cm x 15 cm, facing SW, 18 m high. No chew / claw marks. Bees present	confirmed	2	491
Marri	26	95	45 degrees spout hollow 15 cm x 15 cm, facing SW, 18 m high. No chew / claw markings, bees present		1	486
Marri	22	60			0	483
Introduced	17	80			0	479
FloodedGum	24	80	Three trunks from base, each approx. 80 cm DBH. H1: 45 degree spout hollow 15 cm x 15 cm, 13 m above ground, No chew/ claw marks. Bees present. H2: 45 Degree spout hollow 20 cm x 20 cm, facing SW, 12 m above ground. No chew / claw marks.		2	526

Appendix E

Black Cockatoo Foraging Assessments

Appendix E Black Cockatoo Foraging Assessments

Carnaby's Cockatoo

Habitat	Assess. No.	Initial Quality	Is within the Swan Coastal Plain (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+1)	Does not contain evidence of foraging by species (-2)	No other foraging habitat within 6 km (-2)	Is >12 km from known breeding location (-1)	Is >12km from known roosting site (-1)	Is >2 km from a watering point (-1)	Disease present (-1)	Final Score	General Comments
Drainage with Marri (potential breeding)	BC1	7	3	0	2	2	0	0	0	-1	0	0	0	**13**	Scattered Marri on the SCP with potential breeding trees. Foraging evidence recorded, within 12 km of roosting site and <2km from a watering point.
Scattered Trees (Mostly Marri potential breeding	BC2	7	3	0	2	2	0	0	0	-1	0	0	0	**13**	Scattered trees (predominatly Marri) on the SCP with breeding and potential breeding trees. Foraging evidence recorded adjacent, within 12 km of roosting site and <2km from a watering point.
Marri Woodland (with potential breeding trees)	BC3	7	3	0	2	2	0	0	0	-1	0	0	0	**13**	Marri woodland on SCP. Contains potential breeding trees Foraging evidence recorded adjacent, within 12 km of roosting site and <2km from a watering point.
Wetland / woodland with occasional foraging species	BC4	1	3	0	0	2	0	0	0	-1	0	0	0	**5**	Wetland / Woodland with occasional foraging species on SCP. Foraging evidence recorded in close proximity, within 12 km of roosting site and <2km from a watering point.
Woodland with non-dominant foraging species	BC5	5	3	0	0	2	0	0	0	-1	0	0	0	**9**	Woodland with non-dominant foraging species on SCP. Foraging evidence recorded, within 12 km of roosting site and <2km from a watering point.
Shrubland with occasional foraging species	BC6	1	3	0	0	0	0	-2	0	-1	0	0	0	**1**	Shrubland with occassional foraging species on the SCP. No foraging evidence recorded, within 12 km of roosting site and <2km from a watering point.
Scattered Trees (occ foraging species)	BC7	1	3	0	0	0	0	-2	0	-1	0	0	0	**1**	Scattered trees (with occassional foraging species) on the SCP. No breeding habitat. Foraging evidence not recorded adjacent, within 12 km of roosting site and <2km from a watering point.
Scattered Intro Trees (no breeding trees)	BC8	5	3	0	0	0	0	-2	0	-1	0	0	0	**5**	Scattered intro eucs on the SCP. No breeding habitat. Foraging evidence not recorded adjacent, within 12 km of roosting site and <2km from a watering point.

Habitat	Assess. No.	Initial Quality	Is within the Swan Coastal Plain (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+1)	Does not contain evidence of foraging by species (-2)	No other foraging habitat within 6 km (-2)	Is >12 km from known breeding location (-1)	Is >12km from known roosting site (-1)	Is >2 km from a watering point (-1)	Disease present (-1)	Final Score	General Comments
Scattered Eucalypts (with no breeding habitat)	BC9	7	3	0	0	0	0	-2	0	-1	0	0	0	**7**	Scattered eucalypts on the SCP, no breeding trees. No foraging evidence, within 12 km of roosting site and <2km from a watering point.
Scattered Intro / Occ Native Trees (occ breeding trees)	BC10	5	3	0	0	2	0	-2	0	0	0	0	0	**8**	Scattered intro and occ native eucs on the SCP. Occasional potential breeding tree. Foraging evidence not recorded adjacent, within 12 km of roosting and breeding site and <2km from a watering point.

Baudin's Cockatoo

Fauna Habitat (actually broad veg unit at this stage)	Ass No.	Initial Quality	Is within the known foraging area (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+1)	No other foraging habitat within 6 km (-2)	Is >12km from known roosting site (-1)	Does not contain evidence of foraging by species (-2)	Is >12 km from known breeding location (-1)	Is >2 km from a watering point (-1)	Disease present (-1)	Final Score	General Comments
Drainage with Marri	BC1	7	3	0	2	2	0	0	0	-2	-1	0	0	**11**	Scattered Marri in drainage within known foraging area. Contains potential breeding trees. No foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding not within 12km, and <2km from a watering point.
Scattered Trees (mostly Marri potential breeding	BC2	7	3	0	2	2	0	0	0	-2	-1	0	0	**11**	Scattered trees (predominantly Marri) within known foraging area. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Marri Woodland (with potential breeding trees)	BC3	7	3	0	2	2	0	0	0	-2	-1	0	0	**11**	Marri woodland within known foraging area. Contains potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Wetland with occasional foraging species	BC4	1	3	0	0	2	0	0	0	0	-1	0	0	**5**	Wetland with occasional foraging speciess. Foraging evidence recorded in close proxmity. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Woodland with non-dominant foraging species	BC5	5	3	0	0	2	0	0	0	-2	-1	0	0	**7**	Woodland with non-dominant foraging species within the known foraging area. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Shrubland with occasional foraging species	BC6	1	3	0	0	0	0	0	0	-2	-1	0	0	**1**	Shrubland with occasional foraging species within the known foraging area. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Scattered Trees (occ foraging species)	BC7	1	3	0	0	0	0	0	0	-2	-1	0	0	**1**	Scattered trees with occasional foraging species within the known foraging area. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.

Fauna Habitat (actually broad veg unit at this stage)	Ass No.	Initial Quality	Is within the known foraging area (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily comprises Marri (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+1)	No other foraging habitat within 6 km (-2)	Is >12km from known roosting site (-1)	Does not contain evidence of foraging by species (-2)	Is >12 km from known breeding location (-1)	Is >2 km from a watering point (-1)	Disease present (-1)	Final Score	General Comments
Scattered Intro Trees (no breeding trees)	BC8	5	3	0	0	0	0	0	0	-2	-1	0	0	**5**	Scattered intro eucs within the known foraging area. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Scattered Eucalypts with no breeding habitat)	BC9	7	3	0	0	0	0	0	0	-2	-1	0	0	**7**	Scattered eucalypts within known foraging area. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.
Scattered Intro / Occ Native Trees (occ breeding trees)	BC10	5	3	0	0	2	0	0	0	-2	-1	0	0	**7**	Scattered intro and native eucs within the known foraging area. Within 12 km of confirmed Birdlife (2018) white-tailed roost site (Precautionary Principle used), breeding within 12km unlikely, and <2km from a watering point.

Forest Red-tailed Black Cockatoo

Habitat	Assessment No.	Initial Quality	Jarrah and/or Marri shows good recruitment (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily contains Marri and/or Jarrah (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+2)	No other foraging habitat within 6 km (-2)	Is >12km from known roosting site (-1)	Does not contain evidence of foraging by species (-2)	Is >12 km from known breeding location (-1)	Is >2 km from watering point (-1)	Disease present (-1)	Final Score	General Comments
Drainage with Marri	BC1	7	0	0	2	2	0	0	0	-2	-1	0	0	**8**	Marri in drainage. Contains potential breeding trees. No foraging evidence recorded. Is within 12 km roosting sites and <2km from a watering point.
Scattered Trees (mostly Marri potential breeding	BC2	7	0	0	2	2	0	0	0	-2	-1	0	0	**8**	Scattered trees (predominantly Marri). Contains potential breeding trees. No foraging evidence recorded. Is within 12 km of roositng sites and <2km from a watering point.
Marri Woodland (with potential breeding trees)	BC3	7	0	0	2	2	0	0	0	-2	-1	0	0	**8**	Marri woodland. Contains potential breeding trees No foraging evidence recorded, within 12 km of roosting sites and <2km from a watering point.
Wetland with occasional foraging species	BC4	1	0	0	0	2	0	0	0	0	-1	0	0	**2**	Drainage with occasional foraging species. Foraging evidence recorded in close proximity, within 12 km of roosting sites and <2km from a watering point.
Woodland with non dominant foraging species	BC5	5	0	0	0	2	0	0	0	0	-1	0	0	**6**	Woodland with non-dominant foraging species. Foraging evidence recorded in close proximity, within 12 km of roosting sites and <2km from a watering point.
Shrubland with occasional foraging species	BC6	1	0	0	0	0	0	0	0	-2	-1	0	0	**-2**	Shrubland with occasional foraging species. Foraging evidence recorded not recorded, within 12 km of roosting sites and <2km from a watering point.
Scattered Trees (occ foraging species)	BC7	1	0	0	0	0	0	0	0	-2	-1	0	0	**-2**	Scattered trees with occassional foraging species. No foraging evidence recorded. Within 12 km of roosting sites and <2km from a watering point.
Scattered Intro Trees (no breeding trees)	BC8	5	0	0	0	0	0	0	0	-2	-1	0	0	**2**	Scattered intro eucs. No foraging evidence recorded. Within 12 km of roosting sites and <2km from a watering point.
Scattered Trees (mostly Marri with	BC9	7	0	0	2	0	0	0	0	-2	-1	0	0	**6**	Scattered trees (predominantly Marri). Does not contain potential breeding trees. No foraging evidence recorded. Is within 12 km of roositng sites and <2km from a watering point.

Habitat	Assessment No.	Initial Quality	Jarrah and/or Marri shows good recruitment (+3)	Contains trees known to be used for breeding and / or with suitable nest hollows (+3)	Primarily contains Marri and/or Jarrah (+2)	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo (+2)	Known to be a large or key roosting site (+2)	No other foraging habitat within 6 km (-2)	Is >12km from known roosting site (-1)	Does not contain evidence of foraging by species (-2)	Is >12 km from known breeding location (-1)	Is >2 km from watering point (-1)	Disease present (-1)	Final Score	General Comments
no breeding habitat)															
Scattered Intro / Occ Native Trees (occ breeding trees)	BC10	5	0	0	0	2	0	0	0	-2	-1	**0**	0	**4**	Scattered intro and occ native eucs. No foraging evidence recorded. Within 12 km of roosting sites and <2km from a watering point.