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Maddington Kenwick Strategic Employment Area

Maddington Kenwick Strategic Employment Area

Flora and Fauna Assessment Report

Client: City of Kalamunda

ABN: 60 741 095 678

Prepared by

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Table of Contents

List of Tables

List of Figures

Executive Summary

City of Kalamunda are investigating the Maddington Kenwick Strategic Employment Area (MKSEA) for the purpose of aligning the Local Planning Scheme zone to the existing MRS Industrial zone. Ecological surveys were conducted of this area (survey area) in November 2019 to assess environmental values which will inform the environmental impact assessment.

A detailed flora and vegetation assessment was conducted which included scoring quadrats and traversing the survey area on foot to conduct targeted searches. An assessment was undertaken to determine vegetation communities, vegetation condition, and the presence/absence of Threatened and Priority flora species and communities (TECs and PECs).

Four native vegetation communities were recorded in the survey area, all of which represented degraded vegetation that have been cleared historically. Because of this, the Floristic Community Type (FCT) analysis was unclear and no FCT could be accurately inferred. Despite the ambiguous FCT results, it is unlikely that any of the vegetation communities represent a TEC or PEC. A total of 85% of the vegetation was mapped as in Completely Degraded condition.

No Threatened or Priority flora species were identified within the survey area.

A level 1 fauna survey was conducted which focused on mapping fauna habitat and assessing the potential presence of conservation significant fauna species. Two conservation significant vertebrate fauna species were recorded, including the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act), and the Quenda (*Isoodon fusciventer)* listed as Priority 4 on the DBCA Priority fauna list.

Five fauna habitats were mapped within the survey area including; Scattered Trees, Drainage Line, Woodland, Heath / Shrubland, and Cleared (and Hardstand). Apart from the Cleared fauna habitat, the most common fauna habitat was 'Scattered Trees' occupying 5.21 ha (24.7%) of the survey area. The fauna habitats may be utilised by seven conservation significant fauna species, including:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (EPBC Act & BC Act
- Baudin's Cockatoo (*Calyptorhynchus baudinii)* (EPBC Act & BC Act Endangered)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (EPBC Act & BC Act Vulnerable)
- Masked Owl (southwest) (*Tyto novaehollandiae* subsp. *novaehollandiae*) (EPBC Act Marine/Migratory, BC Act International Agreement)
- Quenda (*Isoodon fusciventer*) (DBCA Priority 4)
- Western Brush Wallaby (*Notamacropus Irma*) (DBCA Priority 4)
- Carter's Freshwater Mussel (*Westralunio carteri)* (EPBC Act & BC Act Vulnerable)

A targeted black cockatoo survey was conducted which assessed foraging, breeding and roosting habitat and included opportunistic observations of foraging evidence. Twenty-three native, hollow-forming eucalypt breeding habitat trees were recorded, of which one contained two potentially suitable hollows for breeding black cockatoos. The survey area contains 21.06 ha of foraging habitat for Carnaby's Cockatoo (*Calyptorhynchus latirostris),* and Baudin's Cockatoo (*Calyptorhynchus baudinii)*, which includes 0.62 ha of Very High Quality and High Quality foraging habitat. The survey area also contains 4.98 ha of foraging habitat for the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), all of which was Low Quality, which reflects the lack of Jarrah (*Eucalyptus marginata)* and Marri (*Corymbia calophylla)* in the survey area.

The biological assessments were successfully completed for the Project with no significant limitations identified.

1.0 Introduction

1.1 Background

The Maddington Kenwick Strategic Employment Area (MSKEA) is an industrial precinct that spans the south-western border of the City of Kalamunda (City) and north-western border of the City of Gosnells (Gosnells). MKSEA has been zoned Industrial under the Metropolitan Region Scheme (MRS) and only partially re-zoned to Light Industry and General Industry under the respective Local Planning Schemes.

The Department of Water and Environmental Regulation (DWER) Environmental Protection Authority services (EPA) has advised that any Scheme Amendment or Structure Plan in the area will likely be called in for formal assessment due to the potential impacts on the existing vegetation, waterway, groundwater or wetlands.

This report presents the ecological assessment results of Precinct 3 of the MSKEA, which may be used to inform future Scheme Amendment proposals in the respective portion of the MSKEA.

1.2 Location

The 25.5 ha survey area is located in Wattle Grove in the City of Kalamunda, Western Australia. The survey area is approximately 13.7 km south-east of Perth and is situated between Welshpool Road (north), Coldwell Road (west) and Brook Road (east).

The location and extent of the survey area is shown in Figure 1.

1.3 Objectives

The primary objective of the ecological assessments was to define the existing environment within the survey area and identify and map conservation significant flora, fauna and vegetation. The assessment accordingly included the collection of information relating to flora, vegetation, fauna, and flora and fauna habitats.

The specific tasks included:

- a desktop assessment to identify significant flora, vegetation and fauna that potentially occur in the area and collate existing information from available sources to develop a comprehensive overview of the survey area
- Detailed flora and vegetation assessment including target flora and community searches, vegetation mapping and condition mapping
- Level 1 fauna assessment including targeted black cockatoo surveys, fauna habitat mapping and assessment of fauna utilisation.

The methods and results of the ecological assessments are presented in this report.

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0 50 100 150 200
Meters

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

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Survey Area
Cadastre

Survey Area

CITY OF KALAMUNDA

MKSEA ECOLOGICAL SURVEY

Figure 1

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2.0 Existing Environment

2.1 Climate

The climate of the Perth Metropolitan Region is described as Warm Mediterranean (Mitchell et al 2002). A Mediterranean climate 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 closest meteorological station to the survey area with comprehensive data is Perth Airport (Station 009021), which is located 6 km northwest of the Study area. Perth Airport meteorological station is maintained by the Bureau of Meteorology (BoM) and commenced recording in 1944.

Perth Airport has experienced an average annual rainfall of 765 mm, with the majority of rainfall occurring between May and September. In the twelve months preceding the survey, rainfall was below average for most months (Figure 2).

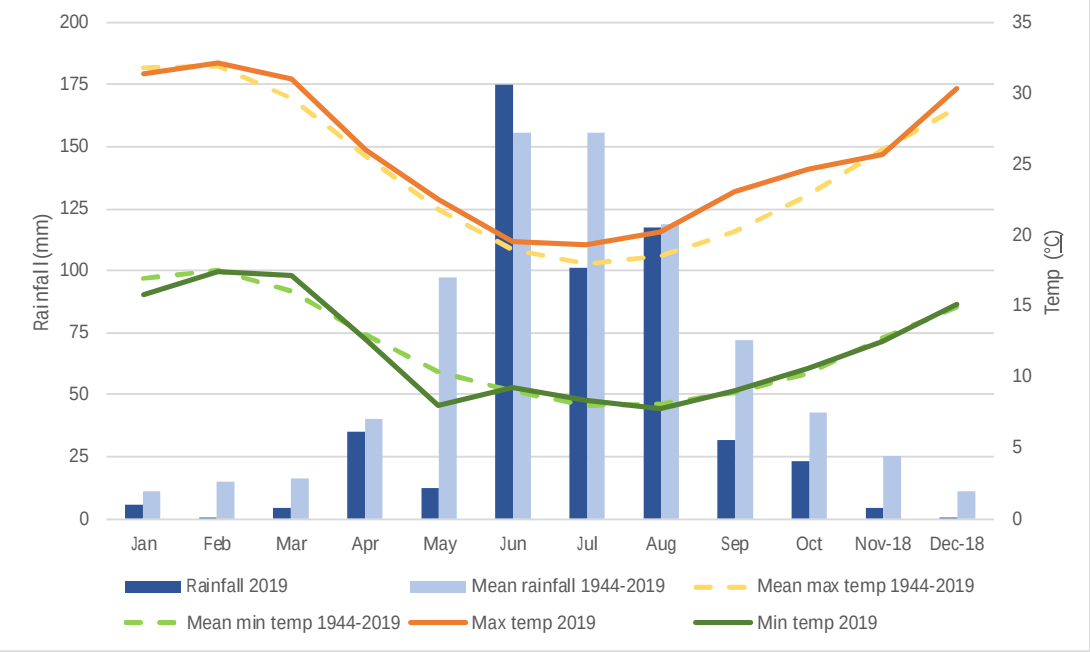

Figure 2 Rainfall data from weather station Perth Airport (009021) showing mean monthly rainfall and rainfall received in the 12 months preceding the field survey (source: BOM, 2019)

2.1 IBRA Regions

The survey area is located on the Swan Coastal Plain bioregion described in CALM (2002), including Perth and the outer suburbs (excluding the Hills suburbs). The Swan Coastal Plain consists of the Dandaragan Plateau and the Perth Coastal Plain and is comprised of a narrow belt less than 30 km wide of Aeolian, alluvial and colluvial deposits of Holocene or Pleistocene age incorporating a complex series of seasonal fresh water wetlands, alluvial river flats, coastal limestone and several offshore islands. Younger sandy areas and limestone are dominated by heath and/or Tuart woodlands, while *Banksia* and *Jarrah-Banksia* woodlands are found on the older dune systems.

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 threatened species and ecological communities.

2.2 Vegetation

The Environmental Protection Authority's (EPA) objective is to retain at least 10% of all pre-European Heddle *et al.* (1980) vegetation complexes in the metropolitan area.

There is one Beard (1981) vegetation association mapped within the survey area (Table 1) comprising of Jarrah, Marri and/or Wandoo woodlands. The entire survey area is encompassed by associated 968.

Table 1 Pre-European vegetation mapping completed by Beard (1979) that occur within the survey area showing percent remaining (Govt. of WA, 2019)

Association	Description	% Remaining Statewide	% Remaining SCP	% remaining in the City
968	Medium woodland; Jarrah, Marri and Wandoo	32.02%	6.62%	14.34%

Heddle *et al.* (1980) completed vegetation complex mapping which used to assess the extent of pre-European vegetation. The survey area is situated on the border of two vegetation complexes, including the Southern River and Guildford complex. These are described in Table 2.

Table 2 Vegetation complex mapping (Heddle *et al.* 1980) that occur within the survey area showing percent remaining in the Perth-Peel region as published in EPA Perth @ 3.5 million (EPA, 2015)

Complex	Description	Percent Remaining SCP	Percent remaining in the City
Southern River	Open woodland of Marri-Jarrah-Banksia on the elevated areas and a fringing woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* along the streams.	16.8%	9.67%
Guildford complex	A mixture of open forest to tall open forest of *C. calophylla – E. wandoo – E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis – M. rhaphiophylla*.	5.87%	10.93%

2.3 Environmentally Sensitive Areas and Conservation Estates

2.3.1 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian Environmental Protection (Environmentally Sensitive Areas) Notice 2005, which was gazetted on 8 April 2005.

Exceptions offered for clearing under Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply within ESAs. ESAs are gazetted due to supporting environmental values of State or Commonwealth importance and, in this situation, include:

- Declared World Heritage properties (EPBC Act)
- areas included on the Register of the National Estate
- defined wetlands and associated buffers
- vegetation within 50 m of rare flora
- Threatened Ecological Communities.

2.3.2 Bush Forever

No Bush Forever sites are located in the survey area. There is one Bush Forever site adjacent to the survey area, Site 387. Site 387 Greater Brixton Street Wetlands is a unique area that supports highly diverse wetland-associated vegetation. It is known to include at least four TECs and over 555 native flora species including numerous threatened and priority species. Govt of WA (2000) describe this site as having 'outstanding flora diversity that includes 33% of all SCP taxa. Bush Forever Site 320 is located north east of the survey area. Site 320 Hartfield Park Bushland supports a number of wetlands and FCTs. It known to include 119 native flora species, including numerous threatened and priority flora species.

2.3.3 Conservation Estates

There are no conservation estates within or directly adjacent to the survey area.

2.4 Wetlands

The locations of wetlands have been determined using the Geomorphic Wetlands of the Swan Coastal Plain dataset adapted from *Hill et al* (1996). The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands of the Swan Coastal Plain. The entire site has been mapped by DBCA as wetlands (Figure 3). The mapping shows seven wetlands wholly or partially in the site (Table 3). Most of the site has been mapped as Multiple Use or Resource Enhancement wetlands. In the southwest of the site is a small area of Conservation category wetlands.

The site is located on the fringe of the Brixton Street Wetlands, which are listed as a nationally important wetlands in *A Directory of Important Wetlands in Australia,* under the name Brixton Street Swamps (Environment Australia, 2001).

Table 3 Wetland types within the survey area

UFI	Category	Type
7771	Resource Enhancement	Sumpland
7772	Conservation	Palusplain
13619	Multiple Use	Palusplain
14426	Conservation	Palusplain
14962	Conservation	Palusplain
15254	Multiple Use	Palusplain
15257	Resource Enhancement	Palusplain

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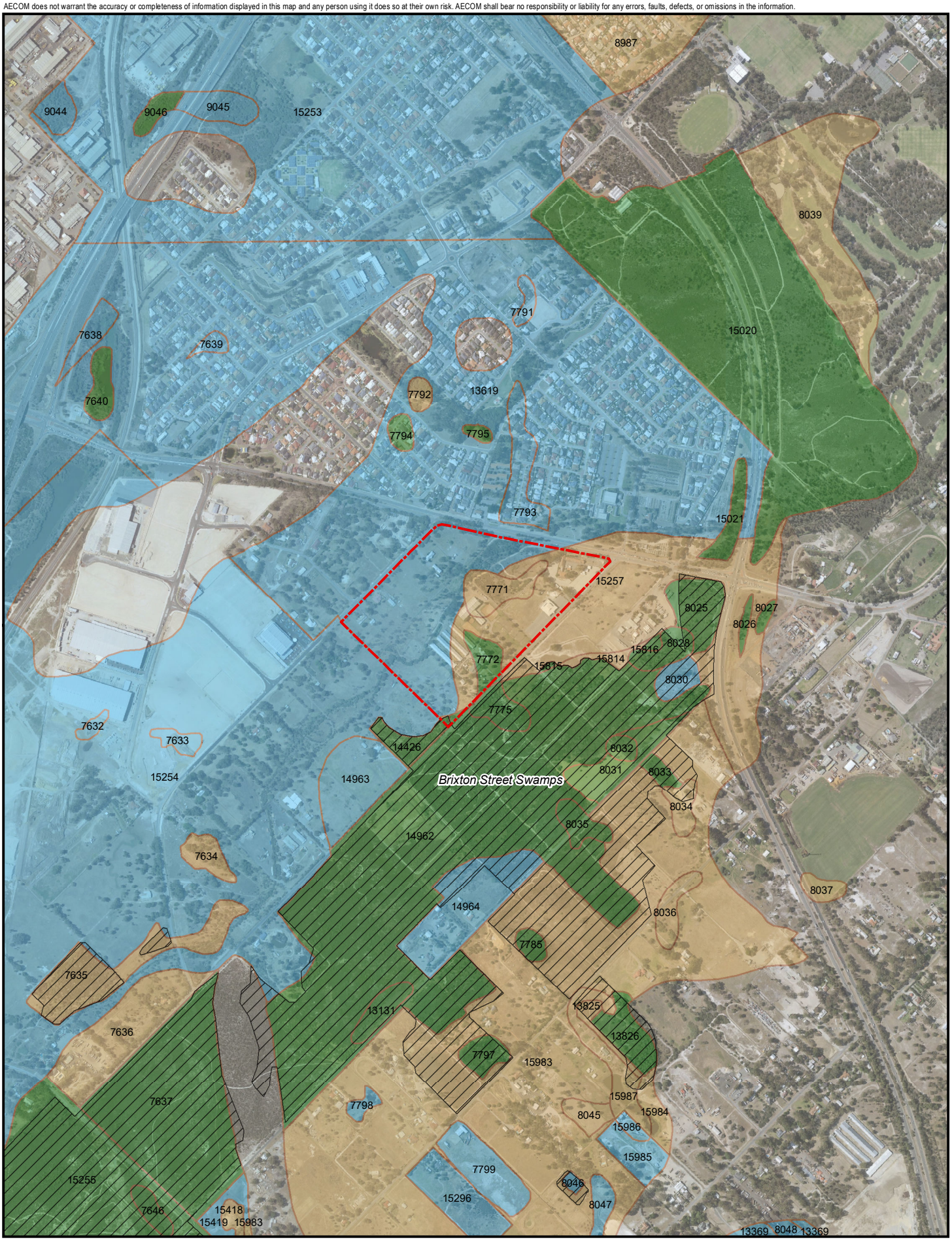

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DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Meters

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
- Directory of Important Wetlands (DBCA)
- Geormophic Wetlands, Swan Coastal Plain (DBCA)

Management Category

- Conservation
- Resource Enhancement
- Multiple Use

Wetlands

CITY OF KALAMUNDA

MKSEA ECOLOGICAL SURVEY

Figure 3

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3.0 Legislative Framework

3.1 Overview

Table 4 summarises the key legislation and guidance governing the protection and management of Western Australia's conservation significant flora, fauna and communities.

Table 4 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, (DSEWPAC, 2012)	These 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)	This Act will replace both the BC Act and the *Sandalwood Act 1929*. On 3 December 2016, several parts of the new Act were proclaimed by the State Governor in the Government Gazette. Provisions that replace those existing under the BC Act and *Sandalwood Act 1929* (including threatened species listings and controls over the taking and keeping of native species) and their associated Regulations have come into effect on 1 January 2019.
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 – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a)	Provides guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in EIA.
EPA Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b)	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 – Sampling Methods for Terrestrial Vertebrate Fauna, (EPA, 2016c)	Provides advice on fauna sampling techniques and methodologies for different regions of the State and the analysis, interpretation and reporting requirements for EIA.

3.2 Federal Legislation - EPBC Act

3.2.1 Matters of National Environmental Significance

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. All Matters of National Environmental Significance (MNES) are listed under the EPBC Act. These 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 a 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

Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 5.

Table 5 Categories of species listed under Schedule 179 of the EPBC Act

Conservation	Code Category
Ex	**Extinct Taxa** which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Conservation	Code Category
CD	**Conservation Dependent** Taxa which at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered the following subparagraphs are satisfied: - the species is a species of fish - the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised the plan of management is in force under a law of the Commonwealth or of a State or Territory cessation of the plan of management would adversely affect the conservation status of the species.
Mi	The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the: - Japan Australia Migratory Bird Agreement 1981 (JAMBA) - China Australia Migratory Bird Agreement 1998 (CAMBA) - Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA) - Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals). All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as a MNES under the EPBC Act.
Ma	Species established under s248 of the EPBC Act.

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 6.

Table 6 Categories of TECs that are listed under the EPBC Act

Code	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

Flora and fauna species 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 7.

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to a 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 8..

Table 7 Conservation codes for WA flora and fauna listed under the *Biodiversity Conservation Act 2016* updated November 2015

Code	Category
CR	**Critically Endangered Species** Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	**Endangered Species** Threatened species considered to be facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
VU	**Vulnerable Species** Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EX	**Extinct Species** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Code	Category
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Table 8 Conservation codes for WA flora and fauna as listed by DBCA and endorsed by the Minister for Environment

Code	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. Such species are in urgent need of further survey.
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. Such species are in urgent need of further survey.
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. Such species are in need of further survey.

Code	Category
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. c. 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

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 9.

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 10.

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 9 Conservation codes for State listed Ecological Communities

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

Table 10 Categories for Priority Ecological Communities

Code	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.

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 Communities of Local, Regional and National Significance

Significant flora and vegetation units need to take into account a number of other features other than statutory listings in accordance with the Flora and Vegetation Environmental Factor Guideline (EPA, 2016a). These include the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- A role as a refuge
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

4.0 Methodology

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 survey area boundary):

- Department of Biodiversity Conservation and Attractions (DBCA) threatened and priority flora, fauna and communities database
- WA Herbarium (WAH) records
- Birdlife (2018) roosting records
- Atlas of Living Australia (AoLA)
- NatureMap
- EPBC Act Protected Matters Search Tool (PMST).

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 11). Available literature was consulted to identify broad vegetation types and describe the existing environment. References included Beard (1981) vegetation mapping, the Biodiversity Audit of Western Australia (CALM 2002), and Heddle et al. (1980) vegetation mapping.

Table 11 Categories of likelihood of occurrence for species and communities

Likelihood Category	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	The 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	The 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 Assessment

A detailed flora and vegetation assessment was undertaken utilising methods outlined in the EPA (2016a) Flora Survey Technical Guide. The assessment was completed by Floora de Wit (collection permit FB62000137) on 6 November 2019. Floora de Wit has 13 years' experience undertaking flora and vegetation assessments on the Swan Coastal Plain. Floora completed a Bachelor of Science in Environmental Biology (Environmental Restoration) and completed a Postgraduate Diploma in Environmental Management and Impact Assessment.

Floristic data was collected from eight quadrats and three relevés.

Quadrats were 10x10 m 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 site was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- sample site type (quadrat/relevé and size)
- photograph (northwest corner)
- soil details (type, colour, moisture)
- landform
- vegetation condition using the Keighery (1994) scale and description of disturbance
- fire history
- comprehensive species list
    - estimated height
    - estimated percentage cover (for trees both percentage within quadrat and within community was recorded to enable better description of vegetation community).

4.2.1.1 Vegetation Mapping

Quantitative flora species data were used to define the vegetation communities. Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003).

Quantitative floristic data and field observations were used to determine the presence of TECs and PECs. Relevant approved conservation advice reports were considered and results supported by the FCT analysis and contextual information relevant to the survey area.

Areas that consisted of native trees only were mapped as such. It is possible that some native trees (as identified in the black cockatoo potential breeding tree assessment) are not captured in a 'Trees' polygon. In these instances, native trees are isolated and occur over planted or cleared land. Trees in paddocks were not captured in the 'Trees' category.

Vegetation condition was determined using the Keighery (1994) condition scale (Table 12). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

Table 12 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

4.2.1.2 Floristic Community Type Analysis

The Keighery (2012) SCP dataset was used for the FCT analysis.

The data from one quadrat in the survey area was reconciled with the SCP dataset. The program PC Ord was used to assess the similarity of the Project quadrat to SCP quadrats. This will in turn determine the inferred FCT of the Project quadrat. The Bray Curtis dissimilarity measure was used to quantify the compositional dissimilarity between the quadrats based on presence absence data. These results were transposed to define the similarity of quadrats. 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).

4.2.2 Level 1 Fauna Survey

A Level 1 fauna survey was conducted in accordance with Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b) and Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA, 2016c). The fauna survey was conducted by Ecologist Jared Leigh on 6 November 2019, in conjunction with the detailed flora and vegetation survey.

The Level 1 fauna survey primarily focused on mapping of fauna habitat and assessing this habitat for potential utilisation by conservation significant fauna species. Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna. 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:
    - large mature trees
    - small and large hollows

  - varying sizes of fallen logs
  - course and fine litter
  - decorticating bark
  - bare ground
  - grass
  - varying sizes of stones and boulders
  - rock crevices
  - soil cracks
  - cryptogramic crust
  - 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.

A fauna species inventory was compiled based on observed fauna and birds identified from distinctive calls, as well as recording indirect evidence such as scats, tracks and diggings. The field survey focussed on searching for conservation significant species identified in the desktop assessment as having the potential to occur in the area. All observations were made between daylight hours of 0700 and 1700.

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).

4.2.1 Targeted Black Cockatoo Survey

A targeted black cockatoo survey was conducted in conjunction with the Level 1 fauna survey by Ecologist Jared Leigh and Botanist Floora de Wit on 6 November 2019. The survey included identifying potential breeding, roosting and foraging habitat for the three threatened black cockatoo species that occur in WA. These are Carnaby's Cockatoo (*Calyptorhynchus latirostris)* listed as Endangered under the EPBC Act and under the BC Act, Baudin's Cockatoo (*Calyptorhynchus baudinii*) listed as Endangered under the EPBC Act and under the BC Act and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* listed as 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). The draft DotEE (2017) Referral Guidelines were also utilised.

4.2.1.1 Breeding Habitat

The black cockatoo breeding habitat assessment focussed on quantifying breeding and potential breeding trees within the survey area. "Potential breeding trees" represent hollow-forming native eucalypt trees with a Diameter at Breast Height (DBH) >500 mm (*Eucalyptus wandoo* and *Eucalyptus salmonophloia* >300 mm), while "breeding trees" represent trees that have suitable hollows as described in the Guidance. Details collected for all breeding trees included:

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

4.2.1.2 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.

4.2.1.3 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 14). This scoring system was amended slightly to incorporate additional habitats and utilised to assess potential foraging habitat throughout the survey area.

The scoring tool is used by initially defining the quality of the overall habitat present (i.e. Very High Quality, High Quality, Quality and Low Quality) and then adding or subtracting points from this depending on the ecological values of the habitat (i.e. proximity to water, proximity to a known roost site, evidence of foraging material etc.). This determines an overall quantitative rating. These scores were then used as representative scores for that unit.

Table 13 defines the levels of foraging habitat quality used during the assessment.

Table 13 Black cockatoo foraging assessment scoring

Score	Foraging Quality
1 – 3	Low Quality
4 – 6	Quality
7 – 8	High Quality
>8	Very High Quality

Table 14 Foraging habitat quality scoring tool for the three black cockatoo species

Starting Score	Carnaby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
10 – Very High Quality	Quality foraging habitat that is being managed for black cockatoos, including successful rehabilitation, and/or has some level of protection from clearing	Quality foraging habitat that is being managed for Black cockatoos, including successful rehabilitation, and/or has some level of protection from clearing	Quality foraging habitat that is being managed for Black cockatoos, including successful rehabilitation, and/or has some level of protection from clearing
7 – High Quality	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (e.g. *Banksia* sp., *Hakea* sp. and *Grevillea* sp.) as well as eucalypt (not mallee) woodland and forest that is dominated by foraging species. Does not include orchards, canola, or areas under a RFA	Eucalypt woodlands and forest, 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 a RFA
5 – Quality	Pine plantation, mallee eucalypts, introduced eucalypts and /or native vegetation with foraging species that are not dominant	Pine plantation nor introduced eucalypts	Introduced eucalypts, mallee eucalypts and /or native vegetation with foraging species that are not dominant, as well as the introduced Cape lilac (*Melia acedarach*)
1 – Low Quality	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 (i.e. evidence of young trees)
+3	Contains trees known to be used for breeding and / or with suitable nest hollows	Contains trees known to be used for breeding and / or with suitable nest hollows	Contains trees known to be used for breeding and / or with suitable nest hollows
+2	Primarily comprises Marri	Primarily comprises Marri	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)		
+1	Known to be a large or key roosting site		
Subtractions: Context adjustor – attributes reducing habitat quality			
-2	Does not contain evidence of foraging by species		
-2	No other foraging habitat within 6 km		
-1	Is >12km from known roosting site		
-1	Is >12 km from known breeding 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

4.3 Survey Limitations

Factors that may have affected the completeness (and therefore the results) of the survey are addressed in Table 15. The EPA published these proposed limitations as a minimum requirement for flora and vegetation surveys in their technical guide (EPA, 2016a).

Table 15 Consideration of limitations that may affect the biological survey completeness

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 (SCP) 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) and Keighery *et al.* (2012) swan coastal plain datasets.	**Minor** Sufficient contextual information is available on the SCP. Resources utilised to inform the black cockatoo survey include the DBCA database, DotEE (2017), Birdlife (2018), and DSEWPac (2012), though not all layers within these resources are updated regularly.	**Nil** Sufficient contextual information is available on the SCP. Some of the resources utilised to inform the level 1 fauna survey include the DBCA database, Naturemap, EPBC Act PMST, AoLA, as well as several field guides and other publications.
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 over three years' experience conducting targeted black cockatoo surveys.	**Nil** Jared is an ecologist with over 16 years' experience in the environmental industry who has conducted multiple Level 1 fauna surveys on the SCP.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Nil** The flora and vegetation was represented by eight relevés and one quadrat. The entire survey area was traversed on foot. Site data can be found in Appendix C.	**Minor** Foraging evidence can be searched for at any time of year, and can remain on the ground for up to two years. Only the Forest Red-tailed Black Cockatoo was recorded through indirect (foraging) evidence. 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 only predominantly observed through indirect evidence.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
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** Potentially suitable hollows could be assessed further by utilising elevated work platforms (EWPs), drones, pole cameras and / or specialist tree climbers, 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 and no further work is required.
Remoteness and/or access problems	**Nil** The entire survey area was accessible. No further work required	**Nil** The entire survey area was accessible. No further work required	**Nil** The entire survey area was accessible. No further work required
Timing, weather, season, cycle	**Minor** Rainfall was below average in the months preceding the survey, in particular in September and October. this may have influenced the presence of annual species.	**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 flora and vegetation 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.

5.0 Desktop assessment Results

5.1 Threatened and Priority Ecological Communities

Eighteen TECs and PECs were identified in the desktop assessment as potentially occurring within the survey area (Table 16). This included nine TECs listed as Endangered or Vulnerable under the EPBC Act.

TECs and PECs identified by the DBCA database searches are mapped with a buffer of 200-500 m depending on their sensitivity to impacts and their conservation significance status. The presence of TEC and PEC buffers overlapping with the survey area can therefore be misleading as it is representative of broad-scale mapping that is most likely to contain the TEC.

Table 16 Threatened Ecological Communities identified in the desktop assessment

Community Name and Description	State Listing	EPBC Act 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 is restricted to the southwest of WA on the Swan Coastal Plain. 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 this project include:	Various	E	May
• *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (FCT20b)	EN		May
• *Banksia attenuata* woodlands over species rich dense shrublands (FCT20a)	EN		Unlikely
• Banksia Dominated Woodlands of the Swan Coastal Plain	P3		May
• Low lying *Banksia attenuata* woodlands or shrublands (FCT221c)	P3		Unlikely
Central Northern Darling Scarp Granite Shrubland Community This PEC occurs in shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs *Xanthorrhoea acanthostachya* and *Allocasuarina humilis* over smaller proteaceous and myrtaceous shrubs, namely *Melaleuca* aff. *scabra, Baeckea camphorosmae.*	P4		Unlikely
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:		CE	Likely
• Herb rich saline shrublands in clay pans (FCT7)	VU		May
• Herb rich shrublands in clay pans (FCT8)	VU		Likely
• Shrublands on dry clay flats (FCT10a)	VU		Likely

Community Name and Description	State Listing	EPBC Act Listing	Likelihood
SCP 3a *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain (FCT3a) Described in DotEE (2017a) approved conservation advice, this TEC is located on heavy soils of the eastern SCP between Ruabon and Guildford. The floristic composition varies with water regime which is typically within 3 m of the natural ground surface therefore communities are likely to be heavily reliant on groundwater. Critical habitat for this TEC includes heavy soils, fresh superficial groundwater, and/or surface water that helps sustain flora species in these wetland communities, and the catchment for this groundwater and surface water. All areas meeting the description of the ecological community are habitat areas critical to its survival (i.e. no condition thresholds apply).	CR	E	Likely
SCP3b *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (FCT3b) Occurs on alluvial soils near the Peel-Harvey estuary and on better drained sites on the eastern side of the plain with vegetation dominated by both *C. calophylla* and *E. marginata* (Gibson *et al.*, 1994). Common understorey species include *Bossiaea eriocarpa and Conostylis juncea*.	VU		May
SCP3c *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (FCT3c) Located on heavy soils of the eastern side of the Swan Coastal Plain between Bullsbrook and Capel. Dominant trees include *C. calophylla, E. wandoo* and shrubs *Xanthorrhoea preissii, Acacia pulchella, Banksia dallanneyi, Gompholobium marginatum* and *Hypocalymma angustifolium* and herbs *Burchardia congesta, Cyathochaeta avenacea* and *Neurachne alopecuroidea*.	CR	E	May
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain Occurs on heavy soils on eastern side of the plain. Occurrences include wetland and well-drained habitats and a variety of landforms. Its presence is defined by limestone-influenced substrates. Soils and flora species are influenced by the type of limestone substrate.	EN	E	Unlikely
Shrublands and Woodlands of the eastern Swan Coastal Plain Occurs on the eastern side of the Swan Coastal Plain in the foothills of the Darling Scarp and reflects this transitional landform and soil zone between the Scarp and the Swan Coastal Plain. Many of the plant species present in the community are more common on the Scarp (DotEE, 2017b). The assemblage also contains species commonly associated with marri - wandoo woodlands on heavy soils.	CR	E	May
SCP02 Southern Wet Shrublands, Swan Coastal Plain (FCT02) Shrublands or open low woodlands identified by Gibson in the Busselton area but is now also known to occur at Perth Airport. The community occurs on seasonally inundated sandy clay soils that support diverse shrubs including *Kingia australis, Eutaxia virgata* and *Calothamnus lateralis*.	EN		Unlikely

Community Name and Description	State Listing	EPBC Act Listing	Likelihood
Subtropical and Temperate Coastal Saltmarsh Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs.	P3	V	Unlikely
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain It mainly occurs on dune formations, particularly the Spearwood and Quindalup dunes, but also along rivers and wetland fringes. It can be a woodland (including as mallee trees) or a forest. The tree canopy is dominated by tuart (*Eucalyptus gomphocephala)* trees.	P3	CE	May

5.2 Conservation Significant Flora

A total of 119 flora species of conservation significance were identified in this desktop assessment. This included 33 species listed as threatened under the EPBC Act and 86 species listed by DBCA as Priority species. Of the 119 species, 95 had known records within 10 km of the survey area. The extensive list of significant flora species is a result of the close proximity of the survey area to a number of wetlands and Bush Forever Sites 387 and 320.

Forty-seven species were considered likely to occur within the survey area, including 14 threatened species and 33 priority species (Table 17). This assessment assumed that a small parcel within the survey area (619 Welshpool Road East) represents native vegetation which appears similar (from aerial imagery) to the adjacent wetland vegetation captured in Bush Forever Site 387.

The comprehensive flora desktop results are presented in Appendix A.

Table 17 Threatened and Priority Flora that are likely to occur within the survey area

Species	Cons. Code[1]		Habitat[2]	Count Date
	EPBC	WA		
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*.	2008
Aponogeton hexatepalus		P4	Species typically found in mud and freshwater areas (ponds, rivers, claypans). Located throughout the Jarrah Forest and SCP, form Serpentine to Murray.	2008
Austrostipa bronwenae	E	EN	Known from flat low-lying calcareous winter wet habitat. Associated with Muchea Limestone in Kenwick, Kemerton and Bunbury.	2013
Babingtonia urbana		P3	Associated with wetlands. Isolated to a few locations including east Perth and north near Dandaragan.	1899
Banksia mimica	E	VU	Flat to gentle slopes on grey sand in open woodlands. DBCA population 3 occurs within the survey area where it occurs in mixed low heath with a *Banksia attenuata/B. menziesii* open-low woodland overstorey. It is associated with species such as *Adenanthos cygnorum, Eucalyptus todtiana, Nuytsia floribunda, Jacksonia floribunda, Xanthorrhoea preissii, Banksia chamaephyton, Hakea conchifolia* and *Stirlingia latifolia*.	2010
Banksia pteridifolia subsp. vernalis		P3	White/grey sand over laterite. Associated with the darling scarp in this locality.	1998
Byblis gigantea		P3	Sandy-peat swamps and seasonally wet areas. One record nearby on golf course.	2001
Calandrinia uncinella		P1	Found near pools, on brown/grey silty sandy loam over granite. Within large saline valey flats and disturbed shrubland.	2014
Calytrix breviseta subsp. *breviseta*	E	CR	Sandy clay and swampy flats. Near the survey area it has been recorded on grey-brown sandy loam to light clays on flats and slopes and low-lying winter-wet areas. This species is known from two populations only, both restricted to Bush Forever Sites.	2012
Chamaescilla gibsonii		P3	Found in winter wet flats and shallow water-filled claypans, in clay to sandy-clay. Located along the Jarrah Forest, Perth and Warren.	2007
Comesperma griffinii		P2	Recorded in yellow or grey sand, dispersed through the south-west province.	2013
Comesperma rhadinocarpum		P3	Grows on sandy soils, throughout the Eremaean Province and South-West Province.	1982
Conospermum undulatum	V	VU	Grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. The species is known from *Banksia* and jarrah/marri woodland, with a few records from slightly swampy habitat	2016
Diuris purdiei	E	EN	Recorded between Perth and Yarloop, growing under dense shrubs in seasonally-wet swamps and drainage lines (Brown *et al.,* 2013).	2007

Species	Cons. Code[1]		Habitat[2]	Count Date
	EPBC	WA		
Drosera occidentalis		P4	Associated with wetlands.	1994
Eleocharis keigheryi	V	VU	Known from north of Eneabba and south-east of Qualeup. Grows in small clumps in a substrate of clay or sandy loam. It is emergent in freshwater creeks and transient waterbodies.	2011
Eremophila glabra subsp. *chlorella*	E	EN	Record near survey area was from a seasonal wetland associated with *Melaleuca viminea* and *M. acutifolia* Tall Open Scrub over *Gahnia trifida* and *Juncus kraussii* Very Open Sedgeland and weeds.	2014
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		P3	No habitat description. Swan Coastal Plain, from Gingin to Serpentine-Jarrahdale.	2009
Eryngium sp. Subdecumbens (G.J. Keighery 5390)		P3	No habitat description. Swan Coastal Plain, Gosnells and Swan.	2010
Grevillea thelemanniana	CE	CR	Occurs on sandy clay soil in flat seasonally wet damplands. Limestone soils are associated with some of the sites. DBCA population 1 occurs near the survey area and is associated with Kenwick Swamp.	2012
Haemodorum loratum		P3	Grey or yellow sand and gravel.	2004
Hydrocotyle lemnoides		P4	Associated with swamps.	2008
Isopogon drummondii		P3	No information available on WAH (1998-). Database results describe flats on grey brown sand with or without gravel in Banksia woodlands.	2006
Isotropis cuneifolia subsp. *glabra*		P3	Grows on sand and clay loam, associated with winter-wet flats.	2008
Jacksonia gracillima		P3	One known record in vicinity grown from winter damp flats. Grey-black sand.	2013
Lasiopetalum bracteatum		P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, and granite outcrops.	2016
Lasiopetalum glutinosum subsp. *glutinosum*		P3	No information available on WAH (1998-). One record nearby recorded on sandplain with Darling Scarp outwash in Banksia/Jarrah woodland.	1897
Lepidosperma rostratum	E	EN	Restricted to two seasonally wet swamps including Kenwick Swamp near the survey area. Grows on peaty sand and clay amongst low heath in winter-wet swamps.	2017
Lepyrodia curvescens		P2	Species grows in sand and laterite, associated with seasonal sumplands.	2008
Macarthuria keigheryi	E	EN	White or grey sand. Records from north of Perth to Dandaragan.	2014
Melaleuca viminalis		P2	No habitat information available on WAH. Found in several IBRA regions in the south-west and north of WA.	2005

Species	Cons. Code[1]		Habitat[2]	Count Date
	EPBC	WA		
Myriophyllum echinatum		P3	Winter-wet clay-based depression, record from Kenwick Swamp.	2010
Ornduffia submersa		P4	No habitat information available. Species recorded throughout the south-west, from Gosnells to Armadale.	2007
Ptilotus pyramidatus	CE	CR	Known from Kenwick area and Greater Brixton Street Wetlands. Inhabits seasonally inundated flat floodplain underlain by pale grey muddy-sand to sandy-mud alluvium of the Pinjarra Plain.	2010
Schoenus benthamii		P3	Found in white or grey sand and sandy clay. Associated with winter-west flats and swamps.	1994
Schoenus capillifolius		P3	Semi-aquatic species, found in brown mud, claypans. Recorded between Gosnells to Waroona.	2009
Schoenus natans		P4	Associated with winter-wet depressions, from the Geraldton Sandplains, Avon Wheatbelt, Swan Coastal Plain, Jarrah Forest and Warren.	2018
Schoenus pennisetis		P3	Species grows in grey or peaty sand and sandy clay. Associated with swamps and winter-wet depressions.	2007
Schoenus sp. Beaufort (G.J. Keighery 6291)		P1	Grows in mud and winter-wet claypans. Recorded in the Avon Wheatbelt and Swan Coastal Plain.	2009
Schoenus sp. Waroona (G.J. Keighery 12235)		P3	Grows in sandy clay to clay, in seasonal wetlands. Recorded in the Perth IBRA region.	1989
Stylidium aceratum		P3	Grows in sandy soils, in swamps. Recorded in Geraldton Sandplains, Jarrah Forest and Swan Coastal Plain IBRA region.	2013
Stylidium longitubum		P4	Species grows in sandy clay to clay, in seasonal wetlands. Recorded in the Geraldton Sandplains, Jarrah Forest, Swan Coastal Plain IBRA regions, between Dandaragan to Busselton.	2012
Styphelia filifolia		P3	No habitat information available. Record near survey area from flats on brown-grey sand adjacent to Hartfield Golf Club.	2006
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. Associated with Kenwick Swamp.	2010
Thelymitra stellata	E	EN	Sand, gravel, lateritic loam. Grows in *Eucalyptus marginata* forests or in low heath on rocky tops of small hills (Brown *et al.*, 2013).	1994
Thysanotus anceps		P3	White or grey sand, lateritic gravel, laterite.	1997
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 (George, 2002). Frequently in association with a few other verticordias in heath, shrubland and open woodland (George, 2002).	2007

1. Conservation codes are outlined in Section 3.0
2. Sourced from Florabase (WAH, 1998-) and DotEE (2019) unless otherwise referenced

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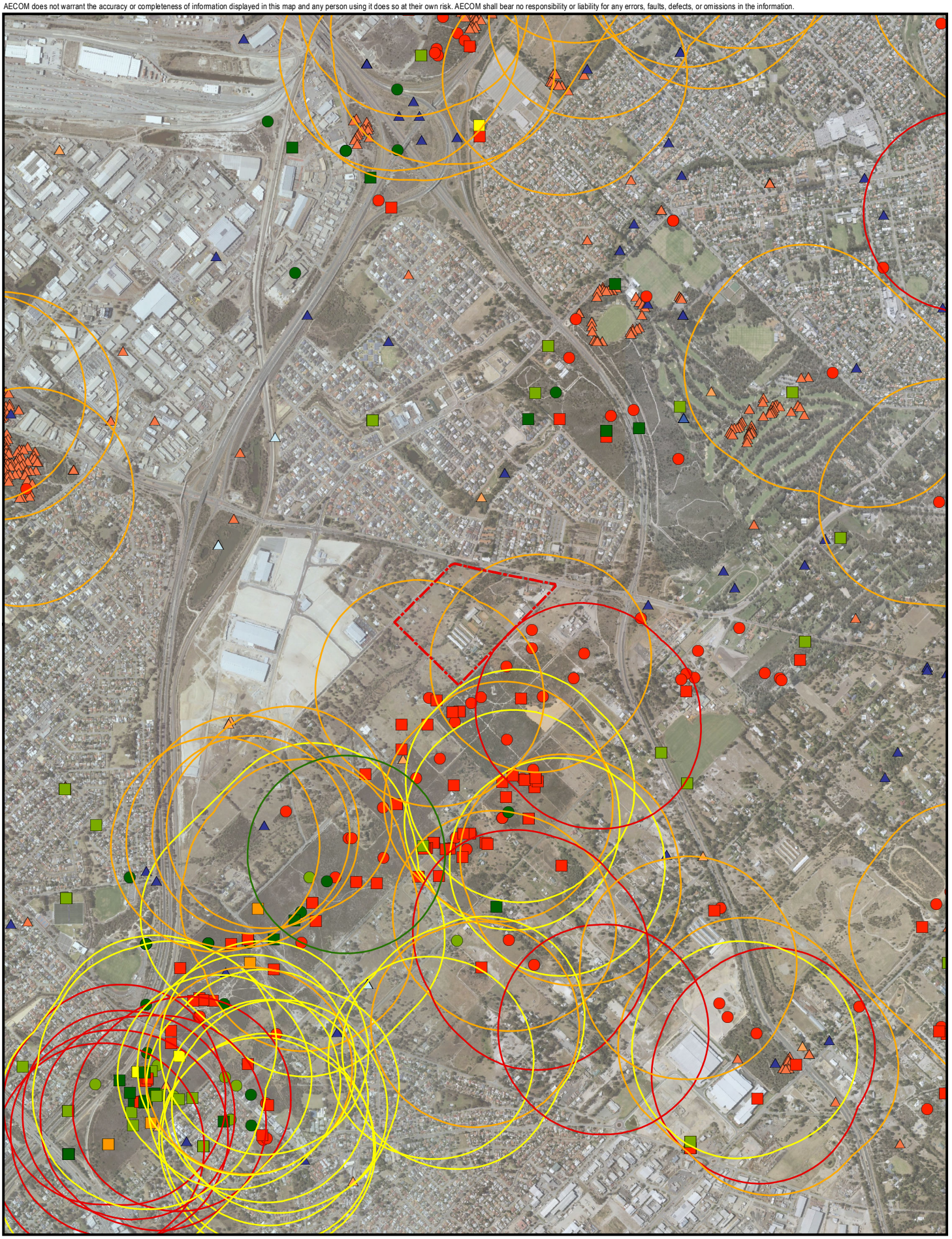

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LEGEND

- Survey Area

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

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

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

Desktop Threatened Fauna
- Endangered
- Vulnerable
- Conservat... Dependant

- International Agreement
- Priority 2
- Priority 3
- Priority 4

Desktop Results for Communities and Species

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Figure 4

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A4 size

5.3 Conservation Significant Fauna

The NatureMap search identified a total of approximately 620 vertebrate and invertebrate fauna species that have been recorded within the survey and surrounding area. The desktop fauna assessment identified fifty conservation significant fauna species that could potentially occur within the survey area. This includes:

- three species that are likely to occur
- five species that may occur
- 42 species that are unlikely to occur.

The eight species considered as ‘likely to occur’ and ‘may occur’ in the survey area include four bird, one invertebrate and three mammal species. Table 18 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 3.0. The comprehensive desktop results are presented in Appendix A and includes all fauna species identified in the desktop, their habitat, likelihood of occurrence, previous count dates and records.

Table 18 Conservation significant fauna species that are likely to occur in the survey area

Scientific Name	Common Name	State Listing	EPBC Act Listing	Count Date	Number of Records	Ecology
Birds						
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	V	2018	17	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.
Calyptorhynchus baudinii	Baudin's Cockatoo	EN	E	2015	5	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).

Scientific Name	Common Name	State Listing	EPBC Act Listing	Count Date	Number of Records	Ecology
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	E	2013	605	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). Diet consists of an array of Proteaceous and *Eucalyptus* species. Foraging habitat, including *Banksia* woodlands, are considered to be habitat critical to the survival of the species (Johnstone *et al*., 2010).
Tyto novaehollandiae subsp. *novaehollandiae*	Masked Owl (southwest)	IA	Marine / Migratory	-	-	The Masked Owl occupies a variety of habitats including forests, open woodlands, farmlands with large trees, paperbark woodlands and caves. This species generally occurs in coastal mainland Australia and though widespread it is typically locally uncommon (Pizzey & Knight, 2007).
Mammals						
Hydromys chrysogaster	Water-rat, Rakali	P4	-	1983	2	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).
Isoodon fusciventer	Quenda	P4	-	2018	148	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).
Notamacropus irma	Western Brush Wallaby	P4	-	1976	2	The western brush wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest.

Scientific Name	Common Name	State Listing	EPBC Act Listing	Count Date	Number of Records	Ecology
Invertebrates						
Westralunio carteri	Carter's Freshwater Mussel	VU	V	2012	6	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).

6.0 Field Survey Results and Discussion

6.1 Vegetation

6.1.1 Floristic Community Type Analysis

The survey area is located on the Southern River and Guildford complexes as mapped by Heddle *et al.* (1980). Five FCTs were inferred from the statistical analysis in Quadrat 5. A brief description of each, including key characteristics, are presented below:

- **4 *Melaleuca preissiana* damplands** (Bassendean). Occurs on Bassendean system. Generally found on Bassendean sands with scattered *M. preissiana* as overstorey. Common species include *Pericalymma ellipticum, Hypolaena exsulca, Hypocalymma angustifolium* and *Dasypogon bromeliifolius*.
- **5 Mixed shrub damplands.** No consistent overstorey. Dominants may include *Banksia ilicifolia, M. preissiana, Actinostrobus pyramidalis* and *Kunzea ericifolia.*
- **6 Weed dominated wetlands on heavy soils.** Occurs on Guildford and Yanga systems. Generally transitional between the moderately species rich Bassendean wetland and the heavy soil communities. It has the highest disturbance rating of any community and has risen from major disturbance events.
- **16 Highly saline seasonal wetlands.** Heterogenous and includes a saline estuarine site. Limited information.
- **S02 Southern wet shrublands**. Occurs on Foothills/Pinjarra Plain system. Limited information presented in Bush Forever.

No FCT was inferred with confidence for the Project quadrat (see Table 19). The quadrat showed a low similarity to a number of SCP quadrats that all represented a different FCT. There was no consistent FCT identified, and similarity was low. This is likely to be a reflection of the historical disturbance that affects the vegetation in the survey area. In 1995 the land adjacent to 619 Welshpool Road East was cleared, isolating this patch from the large remnant wetland vegetation south of the survey area. Around 2010 the vegetation on Lot 619 was cleared. The vegetation currently present represents natural regeneration of vegetation. Species richness is low and weed invasion is high.

The ambiguity of the results has meant that no useful dendrograms were produced. Raw similarity results from the Bray Curtis index is presented in Appendix E.

Table 19 Inferred FCT for MSKEA including quadrat condition, species richness h the Project quadrat, the SCP FCT quadrat, and % similarity)

Quadrat	Condition	Sp. Richness	Quadrat (FCT; % similarity)	Final FCT
Q05	Very Good	29	BULL-7 (5; 24%) hart03 (S02; 23%) much02 (6; 24%) perth10 (4; 25%) WN109MOR (16; 23%)	FCT is unclear. Low similarity likely caused by historical clearing 10-20 years prior, and changes in surface and groundwater hydrology.

6.1.2 Threatened and Priority Ecological Communities

Three TECs were considered likely to occur in the desktop assessment. These were considered during the field survey and data analysis conducted to determine their presence. Data analysis includes the FCT analysis discussed in Section 6.1.1 whereby FCTs align with State listed TECs and PECs. Commonwealth TECs may be represented by FCTs or have their own key diagnostic characteristics to be assessed.

All TECs and PECs considered likely to occur are discussed below.

Claypans of the Swan Coastal Plain (EPBC Critically Endangered; WA Vulnerable)

This TEC encompasses three State listed TECs, of which two are considered likely to occur. The TEC includes three FCTs: FCT7, FCT8 and FCT10a. The identification of this TEC is therefore supported by FCT analysis.

Vegetation community CpHaWm was considered 'likely' to represent this TEC. A quadrat was completed in this vegetation community. The FCT analysis was ambiguous, where no FCT was able to be inferred with confidence. Five FCTs were potentially inferred, which did not include FCT7, FCT8 or FCT10a.

This patch of native vegetation was cleared approximately 20 years prior. It has been isolated from Brixton Street Wetlands since that time and man-made channels have been established to facilitate drainage. As such, the hydrology, soil characteristics, and floristics have changed significantly over time. It is likely that this patch used to reflect values similar to those of Brixton Street Wetlands.

In its current state it is unlikely that this patch represents the Claypans TEC.

SCP 3a *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain (FCT3a) (EPBC Endangered, WA Critically Endangered),

This TEC is known to occur in close proximity to the survey area. It is represented by FCT3a and relies on FCT analysis and the presence of key species (*Kingia australis* and *Corymbia calophylla*). *C. calophylla* trees were observed scattered throughout the survey area. Most of these trees represented isolated trees in paddocks, or over a completely cleared understorey.

Community CcHtWm, situated in the northwest corner, incorporated patches of *C. calophylla* trees which is the only community that may potentially represent FCT3a. No *Kingia* spp. were observed, with understorey mostly devoid of native species. This community was associated with a minor channel and has been historically cleared (20 years prior).

Following the field survey, it is considered unlikely that this TEC is present.

6.1.3 Vegetation Communities

Four vegetation communities were defined and mapped in the survey area. Vegetation communities included:

- Heath – CpHaWm
- Open Woodland – CcHtWm
- Shrubland – CcMvAv
- Riverbank – MrApWm.

All vegetation within the survey area has been historically cleared between 1990 and 2010. Trees along the riverbank are likely to represent the oldest vegetation, while communities recorded on Lot 619 represent regrowth from 2010. As such, none of the communities are likely to reflect values of 'remnant native vegetation' or represent pre-European vegetation due to age of natural succession and ongoing landuse pressure.

Two severely degraded/modified areas were also mapped including paddock and scattered trees in paddocks.

Vegetation communities are described in detail in Table 20 and mapped in Figure 5.

Table 20 Vegetation communities mapped in the survey area

Community Description	Additional Details	Photograph
Heath – CpHaWm *Callitris pyramidalis* and *Melaleuca rhaphiophylla* low scattered trees over *Hypocalymma angustifolium, Melaleuca viminea* subsp. *viminea* and *Eremaea pauciflora* mid shrubland over **Watsonia meriana, Hypolaena exsulca* and *Mesomelaena pseudostygia* mixed forb and sedgeland. This community was difficult to accurately delineate therefore vegetation condition was used to separate this vegetation community from adjacent degraded vegetation. Common hardy perennial species were similar throughout the larger patch however this community resembled 'heath' characteristics where adjacent vegetation did not.	Survey effort: Q5 Species richness: 24 native and seven weed species Condition: Degraded to Very Good Area: 0.11 ha	
Open Woodland – CcHtWm *Corymbia calophylla, Eucalyptus rudis* and *Melaleuca rhaphiophylla* medium open woodland over *Hakea trifurcate, Chamaecytisus palmensis* and *Acacia pulchella* var. *pulchella* tall shrubland over **Watsonia meriana* herbland. Represents interzone between riparian vegetation and adjacent floodplain. Density of strata varies throughout community with some thickets of shrubs present. No bare ground visible due to weed invasion.	Survey effort: R2, R4 Species richness: five native and five weed species Condition: Completely Degraded to Degraded Area: 0.62 ha	

Community Description	Additional Details	Photograph
Shrubland – CcMvAv *Corymbia calophylla* isolated trees with *Melaleuca rhaphiophylla* and *Callitris pyramidalis* low sparse woodland over *Melaleuca viminea* subsp. *viminea, Jacksonia furcellata* and *Xanthorrhoea preissii* mid to tall shrubland over **Avena barbata, *Watsonia* meriana and **Lotus angustissimus* mixed form and grassland.	Survey effort: R6, R7, R8 Species richness: 11 native and six weed species Condition: Degraded Area: 1.91 ha	
Riverbank – MrApWm *Melaleuca rhaphiophylla, Eucalyptus rudis* and *Corymbia calophylla* mid woodland over *Acacia pulchella* var. *pulchella*, *Jacksonia sternbergiana, Trymalium odoratissimum* and *Chamelaucium uncinatum* low sparse shrubland over **Watsonia meriana, **Stenotaphrum secundatum* and **Polypogon monspeliensis* herbland and weeds. Understorey varies according to degrading processes present. Represents riparian vegetation that has important functions and values for maintaining river health.	Survey effort: R1, R3, R9 Species richness: five native and seven weed species Condition: Completely Degraded to Degraded Area: 1.04 ha	

Community Description	Additional Details	Photograph
Degraded/modified vegetation **Paddock** – common pasture weeds. **Scattered Trees** – native trees over common pasture weeds **Hardstand** – paved areas **Cleared** – devoid of native vegetation	Area: 21.86 ha Condition: Completely Degraded	

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LEGEND

Survey Area

Vegetation Unit

- CcHtWm
- CcMvAv
- Cleared
- CpHaWm
- MrApWm
- Paddock
- Trees

Vegetation Communities Mapping

CITY OF KALAMUNDA

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Figure

5

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6.1.4 Vegetation Condition

Vegetation condition within the survey area varied from Completely Degraded to Very Good. The majority of the vegetation was mapped as being Completely Degraded which reflects the cleared paddocks present for 16.99 ha. Vegetation condition has been mapped in Figure 6.

Vegetation condition decline is a result of historical clearing, land use, a drying climate, and unsustainable use of resources (i.e. the river). Weed invasion is prominent and understorey strata are largely absent with the exception of Lot 619.

Cleared area was mapped for 12.16 ha of the survey area. This was not included in the percentage calculations in Table 21.

Table 21 Vegetation condition mapped within the survey area

Condition Rating	Area (ha)	Percentage of survey area (%)
Good/Very Good	0.11	17.75
Degraded	3.69	0.53
Completely Degraded	16.99	16.99
Total	**20.73**	**100**

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0 25 50 75 100
Meters

Data sources:

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LEGEND
Survey Area
Vegetation Condition
Very Good
Degraded
Completely Degraded
Highly Disturbed; Cleared

Vegetation Condition Mapping

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Figure
6

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6.2 Flora

6.2.1 Threatened and Priority Flora

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

This result reflects the current land use of the survey area which is largely rural residential (i.e. horse properties and landscaped gardens). All vegetation within the survey area has been cleared in the past.

6.2.2 Inventory of Flora Species

A total of 53 species from 45 genera and 22 families were recorded within the survey area during the field assessment. The total includes 37 (70%) locally native species.

Families with the highest representation are Myrtaceae (10 native taxa) and Fabaceae (7 native taxa).

A total of 16 introduced species were recorded from the survey area.

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.

6.3 Fauna

6.3.1 Level 1 Fauna Survey

6.3.1.1 Fauna Inventory

Twenty fauna species were recorded within the survey area. This comprised one reptile, one amphibian, three mammal and 15 bird species. The observed species list is presented in Table 22.

Table 22 Fauna species recorded within the survey area

Species	Vernacular	Status	Observations
Birds			
Anthochaera carunculata	Red Wattlebird	Native	Seen and heard several times throughout survey area
Cacatua roseicapilla roseicapilla	Galah	Native	Observed flock flying east over survey area
Calyptorhynchus banksii	Forest Red-Tailed Black Cockatoo	Native	Recorded foraging evidence under Marri in survey area
Corvus coronoides	Australian Raven	Native	Observed two individuals twice during survey
Cracticus tibicen	Australian Magpie	Native	Commonly seen and heard throughout survey
Gerygone fusca	Western Gerygone	Native	Heard several times in or adjacent survey area
Grallina	Magpie-lark	Native	Commonly seen and heard in survey
Gavicalis virescens	Singing Honeyeater	Native	Common throughout survey area
Pardalotus striatus	Striated Pardalote	Native	Heard several times during Survey
Phylidonyris novaehollandiae	New Holland Honeyeater	Native	Commonly seen through shrub and woodland

Species	Vernacular	Status	Observations
Birds			
Platycercus zonarius	Australian Ringneck	Native	Observed flying through survey area multiple times
Rhipidura leucophrys	Willie Wagtail	Native	Commonly seen and heard throughout survey area
Spilopelia senegalensis senegalensis	Laughing Turtle Dove	Introduced	Observed several times in survey area
Threskiornis moluccus	Australian White Ibis	Native	Observed in cleared paddocks in survey area
Trichoglossus moluccanus	Rainbow Lorikeet	Introduced	Observed multiple times flying through and within survey area
Mammals			
Isoodon fusciventer	Southern Brown Bandicoot	Native	Observed typical conical diggings several times in survey area
Oryctolagus cuniculus	Rabbit	Introduced	Observed diggings and scat throughout survey area
Vulpes vulpes	Red Fox	Introduced	Scats recorded
Amphibians			
Crinia glauerti	Clicking Froglet	Native	Heard calling multiple times in drainage lines
Reptiles			
Cryptoblepharus buchananii	Buchanan's Snake-Eyed Skink	Native	Seen multiple times on trees and fallen logs in survey area

6.3.1.2 Conservation Significant Fauna Species

Two species of conservation significance were recorded including:

- Foraging evidence of the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* listed as Vulnerable under the EPBC Act and the BC Act
- Typical conical diggings of the Quenda (*Isoodon fusciventer)* listed as Priority 4 by DBCA.

6.3.1.3 Introduced Species

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

- European Wild Rabbit (*Oryctolagus cuniculus)* – Declared Pest – s22(2) (C3 Prohibited)
- Laughing Turtle-Dove (*Streptopelia senegalensis*) – Permitted – s11
- Rainbow Lorikeet (*Trichoglossus haematodus)* - Declared Pest - s22(2) (C3 Exempt)
- Red Fox (*Vulpes vulpes)* – Declared Pest - s22(2) (C1 Exclusion).

The European Wild Rabbit, Rainbow Lorikeet and Red Fox are listed as Declared Pests under the BAM Act. Generally, these species were recorded sporadically throughout the survey area and surrounds, and were observed directly, or identified by diggings and scats.

Refer to Section 0 for explanations of BAM Act categories.

6.3.1.4 Fauna Habitat

Five fauna habitats (including Cleared) have been defined and mapped (Figure 7 and Table 23). The most common fauna habitat was Cleared Ground extending 12.23 ha (57.8%), followed by Scattered Trees, occupying 5.21 ha (24.7%), and Heath / Shrubland occupying 2.03 ha (9.6%). Drainage Line occupied 1.04 ha (4.9%) and Woodland only occupied 0.62 ha (2.9%). All habitats identified may be utilised by conservation significant fauna species. Fauna habitat utilisation depends on the characteristics of the habitat, defined in Table 23 below. In summary, the following conservation significant species may utilise one or more fauna habitats in the survey area:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*)
- Baudin's Cockatoo (*Calyptorhynchus baudinii)*
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)
- Masked Owl (southwest) (*Tyto novaehollandiae* subsp. *novae-hollandiae*)
- Quenda (*Isoodon fusciventer*)
- Western Brush Wallaby (*Notamacropus Irma*)
- Carter's Freshwater Mussel (*Westralunio carteri)*

6.3.2 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 in a highly fragmented area where the majority of vegetation has been cleared and/or highly modified. One local habitat corridor crosses the survey area in the form of a minor drainage line from the north (Welshpool Road East) past the southern edge of the survey boundary. Although this drainage line is highly degraded, modified and bisected by major roads, it still provides some value as a habitat linkage.

Table 23 Fauna habitats recorded within the survey area

Fauna Habitat	Description	Conservation Significant Species that may Utilise Habitat	Area (ha)	% of survey area	Photo
Heath / Shrubland	This habitat comprises a degraded shrub / heathland with the occasional *Eucalyptus rudis* over weeds. This habitat was considered moderate to low quality fauna habitat due to being highly modified and disturbed with limited structural complexity. Significant fauna habitat characteristics include: • sandy grey soils • bare ground occasional to common abundance • dense understorey present in patches • minimal large trees • vegetation containing occasional small hollows, large hollows rare • decorticating bark and course leaf litter common • stones and boulders generally absent • small and medium sized fallen branches occasional abundance.	• Foraging, breeding and roosting habitat for: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Baudin's Cockatoo (*Calyptorhynchus baudinii)*. • Habitat for the Quenda (*Isoodon fusciventer*) and the Western Brush Wallaby (*Notamacropus irma*).	2.03	9.6	

Fauna Habitat	Description	Conservation Significant Species that may Utilise Habitat	Area (ha)	% of survey area	Photo
Woodland	*Corymbia, Eucalyptus* and *Melaleuca* and *Allocasuarina* tall open woodland over a low shrubland and herbland. This habitat is considered to be moderate quality fauna habitat due to levels of structural complexity and degree of disturbance (weeds, clearing and rubbish). Significant habitat characteristics include: • Presence of small logs and fine litter • Absence of stones and boulders • Presence of weeds • Large hollows rare.	• Foraging and breeding habitat for: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Baudin's Cockatoo (*Calyptorhynchus baudinii)* - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). • Potential habitat for: - Quenda (*Isoodon fusciventer*) - Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*) - Western Brush Wallaby (*Notamacropus irma*).	0.62	2.9	

Fauna Habitat	Description	Conservation Significant Species that may Utilise Habitat	Area (ha)	% of survey area	Photo
Drainage Line	This riparian habitat comprises a highly degraded drainage line running southwest to northeast through the survey area. It contains a scattered *Eucalyptus rudis* and paperbark overstorey, with the occasional Marri, over a layer of open scattered shrubs to 3m, over a closed layer of weeds. Substrate is a sandy clay with minimal aquatic vegetation. This habitat is considered to be moderate quality fauna habitat due to its wetland nature and high degree of disturbance. The significant fauna habitat characteristics include: • Presence of dense understorey • Sandy clayey soils • Minimal aquatic vegetation • Occasional abundance of small to medium fallen branches • Absence of stones and boulders • Leaf litter in occasional abundance • Large trees in occasional abundance • Large hollows rare.	• Foraging, breeding and roosting habitat for: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Baudin's Cockatoo (*Calyptorhynchus baudinii)* - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). • May provide habitat for - Quenda (*Isoodon fusciventer*) - Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*) - Western Brush Wallaby (*Notamacropus irma*) - Water Rat (*Hydromys chrysogaster*) - Carter's Freshwater Mussel (*Westralunio carteri)*.	1.04	4.9	 

Fauna Habitat	Description	Conservation Significant Species that may Utilise Habitat	Area (ha)	% of survey area	Photo
Scattered Trees	This habitat is varied and contains large mature native and non-native eucalypt trees over cleared / paddocks. The significant fauna habitat characteristics include: • Presence of large mature trees (where eucalypts present) • Absence of understorey • Small hollows are occasionally present, large hollows are rare • Logs of all sizes are rare to occasionally present • Course and fine litter is present but generally only under trees. • Bare sandy ground abundant • Absence of stones, boulders and rock crevices.	• Foraging, roosting and breeding habitat for: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Baudin's Cockatoo (*Calyptorhynchus baudinii)* - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). • May provide habitat for - Quenda (*Isoodon fusciventer*) - Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*) - Western Brush Wallaby (*Notamacropus irma*).	5.21	24.7	 

Fauna Habitat	Description	Conservation Significant Species that may Utilise Habitat	Area (ha)	% of survey area	Photo
					
Cleared	This habitat consists of cleared areas / paddocks predominantly devoid of vegetation. It may contain the occasional scattered tree or shrub. It is generally low quality fauna habitat except for where the occasional tree or shrub may provide habitat.	• Depending on the occasional isolated tree present, it may provide habitat for: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Baudin's Cockatoo (*Calyptorhynchus baudinii)* - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*	12.23	57.8	

Note: 4.41 ha of hardstand areas (e.g. buildings, roads etc) were also mapped, however these provide little in the way of fauna habitat.

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LEGEND

Survey Area

Fauna Habitat

- Cleared
- Drainage Line
- Hardstand
- Heath / Shrubland
- Scattered Trees
- Woodland

Fauna Habitat

CITY OF KALAMUNDA

MKSEA ECOLOGICAL SURVEY

Figure

7

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6.3.3 Targeted Black Cockatoo Survey

6.3.3.1 Ecology

6.3.3.1.1 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 not observed during the field survey.

6.3.3.1.2 Baudin's Cockatoo

Baudin's Cockatoo (*Calyptorhynchus baudinii)* is endemic to the south-west of Western Australia from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Kojonup, where it inhabits eucalypt forests.

This species usually feeds in eucalypt woodlands and forest, and proteaceous woodland and heath. During the breeding season feed primarily on native vegetation, particularly marri. Outside the breeding season, may feed in fruit orchards (mostly apple and pear, but also persimmon) and tips of *Pinus* spp. It feeds mostly on marri (seeds, flowers, nectar and grubs) and proteaceous trees and shrubs. Also, other native seeds and introduced fruits; insects and insect larvae; pith of kangaroo paw *Anigozanthos flavidus*; juice of ripe persimmons; tips of Pinus spp. and seeds of apples and pears.

Baudin's Cockatoo generally breeds in woodland or forests, but may also breed in former woodland or forest now present as isolated trees. It nests in hollows in live or dead trees of karri *Eucalyptus diversicolor*, marri *Corymbia calophylla*, wandoo *E. wandoo* and tuart *E. gomphocephala.*

Baudin's Cockatoos were not observed during the field survey.

6.3.3.1.3 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 marginata*) seeds, but also feeding on Blackbutt (*E. patens*), Albany Blackbutt (*Eucalyptus 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.

The Forest Red-tailed Black Cockatoo was not directly observed during the field survey.

6.3.3.2 Breeding

The SCP is used by black cockatoos primarily for foraging resources, however their breeding ranges are expanding due to heavy historic clearing, and small patches of breeding habitat are now being utilised across the SCP. The survey area contains a total of 23 hollow-forming, native eucalypt trees with potentially suitable hollows or a DBH >500 mm. Twenty-two of these were Flooded Gums (*Eucalyptus rudis),* with the remaining tree being a Marri (*Corymbia calophylla)*. Refer to Table 24 for the details of these trees and Figure 8 for locations of these trees. The majority of these trees are in the Drainage Line and Isolated Trees fauna habitats.

Hollow formation in *Eucalyptus* trees is a result of a number of processes including fungal attack, termites and fire, and the propensity for hollow formation varies between *Eucalyptus* species (Whitford, 2002). In order to be suitable for black cockatoos, hollow entrances need to be at least 100 mm in diameter. Hollows are not always able to fully assessed from the ground, especially in regards to depth of the hollow and hollow floor space, and the Precautionary Principle is adhered to when this is the case.

One of the Flooded Gums (*Eucalyptus rudis*) had two potentially suitable hollows for breeding black cockatoos. Hollow 1 was a trunk hollow, with an opening 10 cm x 15 cm, was four metres above ground; and had possible old chew marks. Hollow 2 was a branch hollow, with an opening 10 cm x 20 cm; was eight metres above ground, with no chew / claw marks.

Refer to Plate 1 for the details of the tree with potentially suitable hollows, for locations of these trees and Appendix D for full details of all 23 trees.

Plate 1 Potentially suitable black cockatoo breeding hollows - tree ID 11. Right Hollow 1, left Hollow 2.

Table 24 Black cockatoo breeding habitat trees in the survey area

ID	Species	Height (m)	DBH (cm)	Number of Potentially Suitable Hollows	Comments
2	Flooded Gum (*Eucalyptus rudis*)	15	63	0	
3	Flooded Gum (*Eucalyptus rudis*)	15	56	0	
4	Marri *(Corymbia calophylla)*	14	60	0	
5	Flooded Gum (*Eucalyptus rudis*)	10	53	0	
6	Flooded Gum (*Eucalyptus rudis*)	8	50	0	Multiple trunks, diseased trees.
7	Flooded Gum (*Eucalyptus rudis*)	8	55	0	Unhealthy tree
8	Flooded Gum (*Eucalyptus rudis*)	8	120	0	Unhealthy tree
9	Flooded Gum (*Eucalyptus rudis*)	18	90	0	
10	Flooded Gum (*Eucalyptus rudis*)	8	65	0	Unhealthy tree
11	Flooded Gum (*Eucalyptus rudis*)	10	150	2	
12	Flooded Gum (*Eucalyptus rudis*)	10	60	0	Unhealthy tree
13	Flooded Gum (*Eucalyptus rudis*)	8	60	0	Unhealthy tree
14	Flooded Gum (*Eucalyptus rudis*)	15	80	0	
15	Flooded Gum (*Eucalyptus rudis*)	12	50	0	
16	Flooded Gum (*Eucalyptus rudis*)	15	51	0	
17	Flooded Gum (*Eucalyptus rudis*)	12	52	0	
18	Flooded Gum (*Eucalyptus rudis*)	15	80	0	
20	Flooded Gum (*Eucalyptus rudis*)	16	100	0	
21	Flooded Gum (*Eucalyptus rudis*)	14	70	0	
22	Flooded Gum (*Eucalyptus rudis*)	14	65	0	
23	Flooded Gum (*Eucalyptus rudis*)	14	60	0	
24	Flooded Gum (*Eucalyptus rudis*)	16	60	0	
25	Flooded Gum (*Eucalyptus rudis*)	16	52	0	

6.3.3.3 Foraging Habitat

Carnaby's Cockatoo

The survey area contains 21.06 ha of foraging habitat for Carnaby's Cockatoo. This includes 0.62 ha of Very High Quality and High Quality foraging habitat, which generally consisted of open woodlands on the SCP, with potential breeding trees. Foraging habitat is presented spatially in Figure 9, and the total areas for each foraging quality are presented in Table 25. The foraging quality assessments are presented in Appendix D.

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

Table 25 Carnaby's Cockatoo foraging habitat areas

Foraging Quality	Areas (ha)
Low Quality (1-3)	16.08
Quality (4-6)	4.36
High Quality (7-8)	0.62
Very High Quality (>8)	0
TOTAL	**21.06**

Baudin's Cockatoo

The survey area contains 21.06 ha of foraging habitat for Baudin's Cockatoo. This includes 0.62 ha of Very High and High Quality foraging habitat, which generally consisted of open woodlands on the SCP, with potential breeding trees. Foraging habitat is presented spatially in Figure 10, and the total areas for each foraging quality are presented in Table 26. The foraging quality assessments are presented in Appendix D.

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

Table 26 Baudin's Cockatoo foraging habitat areas

Foraging Quality	Areas (ha)
Low Quality (1-3)	17.12
Quality (4-6)	3.32
High Quality (7-8)	0.62
Very High Quality (>8)	0
TOTAL	**21.06**

Forest Red-tailed Black Cockatoo

The survey area contains 4.98 ha of foraging habitat for the Forest Red-tailed Black Cockatoo, all of which was Low Quality. This generally reflects the lack of Jarrah (*Eucalyptus marginata)* and Marri (*Corymbia calophylla)* in the survey area. Foraging habitat is presented spatially in Figure 11, and the total areas for each foraging quality are presented in Table 27.

Potential foraging evidence from the Forest Red-tailed Black Cockatoo was recorded in one location directly adjacent Welshpool Road. Refer to Plate 2 and Figure 11.

Table 27 Forest Red-tailed Black Cockatoo foraging habitat areas

Foraging Quality	Areas (ha)
Low Quality (1-3)	4.98
Quality (4-6)	0
High Quality (7-8)	0
Very High Quality (>8)	0
TOTAL	**4.98**

Plate 2 Probable Forest Red-tailed Black Cockatoo Foraging Evidence

6.3.3.4 Roosting Habitat

Carnaby's Cockatoo and Baudin's Cockatoo typically roost in the tallest trees in the landscape in or near riparian environments or near other permanent water sources. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting (DSEWPaC, 2012). 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. The Birdlife (2018) black cockatoo roosting data identified a number of confirmed black cockatoo roost sites adjacent the survey area, including:

- Site GOSKENR001 approximately 500 m west of the survey area; a confirmed Forest Red-tailed Black Cockatoo roost
- Site KALFORR003 approximately 700 m north-east of the survey area; a confirmed Forest Red-tailed Black Cockatoo roost.
- Site KALWATR001 approximately 1.2 km east of the survey area; a confirmed non-Great Cocky Count "white-tailed" black cockatoo roost.

6.3.3.5 survey area Context

The survey area is located adjacent to a large area of metropolitan fauna habitat, Bush Forever Site 387 to the south east and Bush Forever Site 320 to the north east. The woodlands and scattered mature eucalypts located within these Bush Forever sites and surrounds would provide foraging, breeding and roosting habitat for Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo directly adjacent the survey area.

In addition to the black cockatoo foraging habitat available directly adjacent the survey area, the local region also includes the eucalypt and Banksia woodlands and forests on the western edge of the Darling Scarp to the east. This area contains significant areas of foraging habitat for all three black cockatoo species. Significant areas of breeding and roosting habitat are also likely to be found within these eucalypt woodlands and forests.

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LEGEND
Survey Area
Fauna Habitat
Cleared
Drainage Line
Hardstand
Heath / Shrubland
Scattered Trees
Woodland

Fauna Habitat

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Figure
8

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LEGEND
Survey Area
Black Cockatoo Breeding Trees
Potential Black Cockatoo Breeding Trees
Species
Flooded Gum *Eucalyptus rudis*
Marri *Corymbia calophylla*

Black Cockatoo Breeding Habitat

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Figure
9

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LEGEND
- Survey Area
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees

Carnaby's Cockatoo Foraging Habitat
- Low Quality
- Quality
- High Quality
- Very High Quality

Carnaby's Cockatoo Foraging Habitat

CITY OF KALAMUNDA

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Figure

10

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LEGEND
- Survey Area
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees

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

Baudin's Cockatoo Foraging Habitat

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Figure
11

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7.0 Conclusions

Ecological assessments including a detailed flora and vegetation, level 1 fauna and targeted black cockatoo surveys were undertaken for the MKSEA Project on behalf of the City of Kalamunda. 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:

- No TEC or PECs were recorded despite identifying numerous TECs and PECs in close proximity.
- No Threatened or Priority flora species were recorded and none were known to occur according to DBCA database results.
- Two conservation significant fauna species were recorded within and/or directly adjacent to the survey area, comprising Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* listed as Vulnerable under the EPBC Act and the BC Act and Quenda (*Isoodon fusciventer)* listed as Priority 4 by DBCA.
- Five fauna habitats were defined with Scattered Trees occupying the majority of the survey area (20.4%). This habitat may be utilised by Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Western Brush Wallaby (*Notamacropus Irma*) and the Quenda (*Isoodon fusciventer*).
- Twenty-three native, hollow-forming eucalypt breeding habitat trees were recorded, one Flooded Gum (*Eucalyptus rudis)* which contained two potentially suitable hollows for breeding black cockatoos.
- The survey area contained black cockatoo foraging habitat for all three Western Australian threatened black cockatoo species, this comprised:
  - 21.06 ha of foraging habitat for Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo (*Calyptorhynchus baudinii)*, which included 0.62 ha of High Quality and Very High Quality foraging habitat
  - 4.98 ha of foraging habitat for the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), all of which was Low Quality. This generally reflects the lack of Jarrah (*Eucalyptus marginata)* and Marri (*Corymbia calophylla)* in the survey area.

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

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Appendix A

Desktop Results

Appendix A Desktop Results

A1: Protected Matters Search Report

A2: Desktop Flora

A3: Desktop Fauna

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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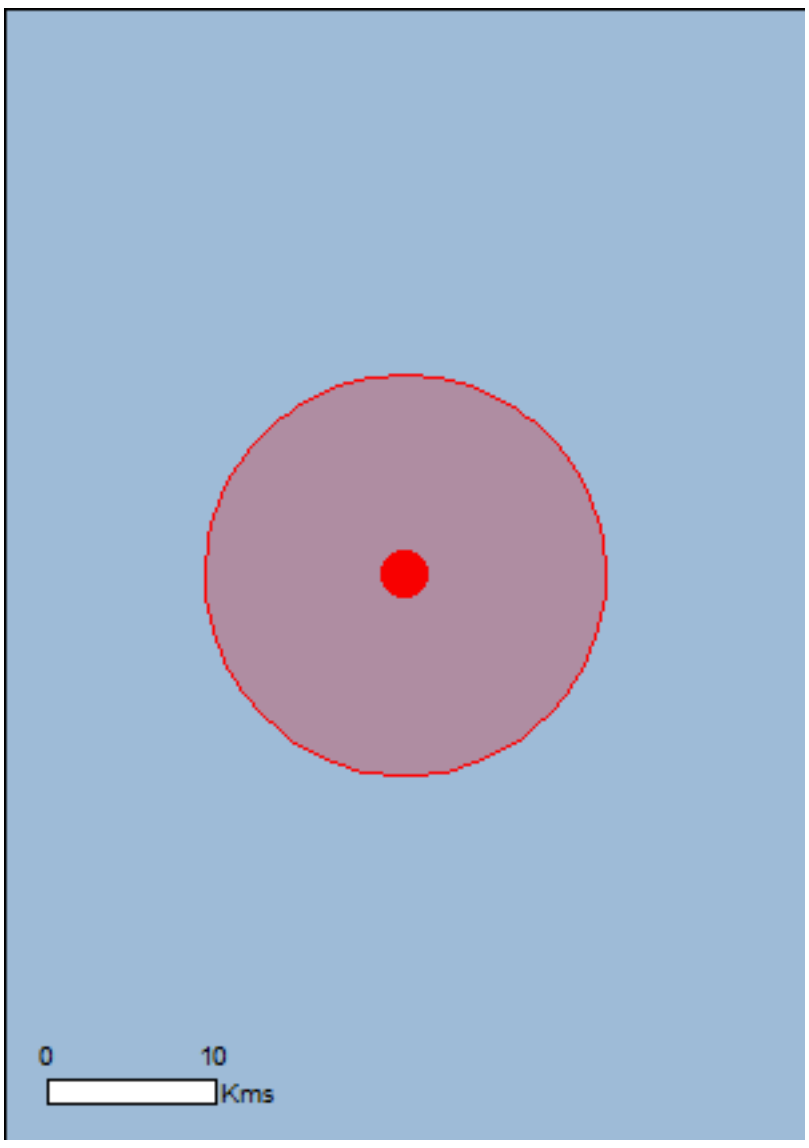

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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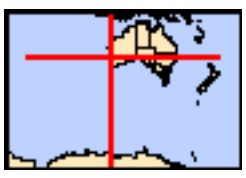

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	65
Listed Migratory Species:	25

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	6
Commonwealth Heritage Places:	1
Listed Marine Species:	32
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	19
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Insects		
Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder,	Critically Endangered	Species or species

Name	Status	Type of Presence
Ngoor, Ngoolangit [25911]		habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia anomala Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat known to occur within area
Acacia aphylla Leafless Rock Wattle [13553]	Vulnerable	Species or species habitat known to occur within area
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
Anthocercis gracilis Slender Tailflower [11103]	Vulnerable	Species or species habitat known to occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat known to occur within area
Austrostipa jacobsiana [87809]	Critically Endangered	Species or species habitat known to occur within area
Banksia mimica Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Calytrix breviseta subsp. breviseta Swamp Starflower [23879]	Endangered	Species or species habitat known to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
Conospermum undulatum Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
Darwinia apiculata Scarp Darwinia [8763]	Endangered	Species or species habitat known to occur within area
Diplolaena andrewsii [6601]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Eremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat known to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat known to occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Ptilotus pyramidatus Pyramid Mulla-mulla [18216]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area
Reptiles		

Name	Status	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Manta alfredi](#) Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
[Manta birostris](#) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Breeding known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -
Defence - AIRTC CANNINGTON
Defence - BUSHMEAD RIFLE RANGE
Defence - BUSHMEAD TRAINING AREA
Defence - HOLDFAST BARRACKS
Defence - PALMER BARRACKS - SOUTH GUILDFORD

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
[Victoria Park Post Office](#)	WA	Listed place

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Mammals		
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Beelu	WA
Canning River	WA
Dundas Road	WA
Gooseberry Hill	WA
Helena River	WA
Kalamunda	WA
Kenwick Wetlands	WA
Korung	WA

Name	State
Lesmurdie Falls	WA
Swan River	WA
Unnamed WA23076	WA
Unnamed WA24657	WA
Unnamed WA29815	WA
Unnamed WA36440	WA
Unnamed WA37997	WA
Unnamed WA49079	WA
Unnamed WA49299	WA
Unnamed WA49362	WA
Unnamed WA49363	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State

Name	State
Brixton Street Swamps	WA
Gibbs Road Swamp System	WA
Perth Airport Woodland Swamps	WA
Swan-Canning Estuary	WA

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.00946 115.98869

Acknowledgements

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

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

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

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

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Appendix A - Desktop Flora Assessment

Species	EPBC	WA	Habitat[1]	Likelihood of Occurrence	Count Date
Acacia anomala	V	VU	Grows on laterite in shallow sand, loam, clay or gravel that is brown, yellow or grey. Found on ridges, slopes and low plains. It grows entangled amongst other low shrubs in dense vegetation. Known from 13 populations including Kalamunda/Bickley, Chittering/Bullsbrook, and Pickering Brook.	May	1991
Acacia aphylla	V	VU	Associated with laterite and granite outcrops on hillsides. Grows in open forest dominated by *Eucalyptus marginata, Corymbia calophylla* or *Eucalyptus loxophleba.*	Unlikely	2016
Acacia benthamii		P2	Typically found on limestone breakaways, and sand. Recorded along the SCP from Dandaragan to Rockingham.	Unlikely	1994
Acacia drummondii subsp. affinis		P3	Species grows in lateritic gravelly soils, in the Avon Wheatbelt, SCP and Jarrah Forest.	Unlikely	
Acacia horridula		P3	Found in gravelly soils over granite, rocky hillsides. Recorded in the Northerna Jarrah Forest and Perth IBRA subregions, from Gingin to Serpentine-Jarradale.	Unlikely	2008
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)		P1	Found between Cockburn to Serpentine-Jarrahdale/Murry, typically on grey or black sand over clay. It grows in swampy areas and winter wet lowlands.	Unlikely	1980
Acacia oncinophylla subsp. oncinophylla		P3	Species recorded on granitic soils, occasionally on laterite. Located from Gosnells to Wandering.	May	
Acacia oncinophylla subsp. *patulifolia*		P4	Granitic soils, sometimes on laterite. Recorded on the Scarp.	May	2015
Allocasuarina grevilleoides		P3	Species found on sand over laterite or gravel. Located from the Geraldton Sandplains to the Jarrah Forest.	Unlikely	2008
Amanita kalamundae		P3		May	1989
Amanita preissii		P3		May	2005
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* .	Likely	2008
Andersonia sp. Blepharifolia		P2	No habitat information provided. Found in Gosnells and Kalamunda in the Northern Jarrah Forest.	May	1996
Angianthus micropodioides		P3	Species grows in saline sandy soils, along rive edges, saline depressions and claypans. Species grows in both Eremaean and South-West Province, from Southern Cross to Perth.	Unlikely	2015
Anigozanthos viridis subsp. Terraspectans	V	VU	Found in grey sand or clay loam, and in winter-wet depressions. Species located in Dandaragan and Gingin.	Unlikely	
Anthocercis gracilis	V	VU	Known from nine populations growing on steep granite slopes along the Darling Scarp in shallow, humus-rich sandy or loamy soils.	Unlikely	2007
Aponogeton hexatepalus		P4	Species typically found in mud and freshwater areas (ponds, rivers, claypans). Located throughout the Jarrah Forest and SCP, form Serpentine to Murray.	Likely	2008
Asteridea gracilis		P3	Species recorded on sand, clay and gravelly soils. Located in the South-west province from Gosnells to Plantagenet.	May	2015
Austrostipa bronwenae	E	EN	Known from flat low-lying calcareous winter wet habitat. Associated with Muchea Limestone in Kenwick, Kemerton and Bunbury.	Likely	2013
Austrostipa jacobsiana	CE	CR	Known from flat low-lying area on fringe of seasonally wet depression on calcareous clay to fine sandy clay on the SCP, and at one location in Bunbury.	May	
Babingtonia urbana		P3	Associated with wetlands. Isolated to a few locations including east Perth and north near Dandaragan.	Likely	1899
Banksia kippistiana var. paenepeccata		P3	Species found in lateritic gravelly soils. Located from Dandaragan to Armadale.	Unlikely	2005
Banksia mimica	E	VU	Flat to gentle slopes on grey sand in open woodlands. DBCA population 3 occurs within the survey area where it occurs in mixed low heath with a *Banksia attenuata/B. menziesii* open-low woodland overstorey. It is associated with species such as *Adenanthos cygnorum, Eucalyptus todtiana, Nuytsia floribunda, Jacksonia floribunda, Xanthorrhoea preissii, Banksia chamaephyton, Hakea conchifolia* and *Stirlingia latifolia*	Likely	2010
Banksia pteridifolia subsp. vernalis		P3	White/grey sand over laterite. Associated with the darling scarp in this locality.	Likely	1998
Beaufortia purpurea		P3	Plant found on lateric or granitic soils, and on rocky slopes. Located in the Northern Jarrah Forest and Perth.	Unlikely	2015
Bolboschoenus fluviatilis		P1	No habitat information provided. Found in Bassendean, Bayswater, Gosnells and Swan.	May	2004
Boronia humifusa		P1	Species grows on gravelly clay loam over laterite, in jarrah-marri open forest. Species located in Busselton, Capel, Donnybrook-Balingup and Kalamunda.	Unlikely	2002
Boronia tenuis		P4	Laterite, stony soils. Granite.	Unlikely	2011
Byblis gigantea		P3	Sandy-peat swamps and seasonally wet areas. One record nearby on golf course.	Likely	2001
Caladenia huegelii	E	CR	Found between Perth and Capel growing in deep sandy soil in *Banksia-Eucalyptus marginata* woodland.	Unlikely	2005
Calandrinia sp. Piawaning		P1	Found near pools, on brown/grey silty sandy loam over granite. Within large saline valeey flats and disturbed shrubland.	Likely	2014
Calothamnus accedens		P4	Grows in sandy soils over laterite and along road verges. Found throughout the Avon Wheatbelt, Geraldton Sandplains, Jarrah Forest and Swan Coastal Plain.	Unlikely	2008
Calothamnus graniticus subsp. Leptophyllus		P4	Found in clay over granite or lateric soils and hillsides. Located in the Jarrah	Unlikely	2005

Appendix A - Desktop Flora Assessment

Species	EPBC	WA	Habitat[1]	Likelihood of Occurrence	Count Date
Calytrix breviseta subsp. *breviseta*	E	CR	Sandy clay and swampy flats. Near the survey area it has been recorded on grey-brown sandy loam to light clays on flats and slopes and low-lying winter-wet areas. This species is known from two populations only, both restricted to Bush Forever Sites.	Likely	2012
Carex tereticaulis		P3	Recorded on black peaty sand, in the Jarrah Forest, Perth and Warren.	Unlikely	2004
Chamaescilla gibsonii		P3	Found in winter wet flats and shallow water-filled claypans, in clay to sandy-clay. Located along the Jarrah Forest, Perth and Warren.	Likely	2007
Chamelaucium sp. Gingin (N.G. Marchant 6)	E	VU	Confined to the Gingin/Chittering area within a 3km range. Occurs on white/yellow sand supporting open low woodlands of *Eucalyptus todtiana, Banksia attenuata* and *Hibbertia* species.	Unlikely	
Comesperma griffinii		P2	Recorded in yellow or grey sand, dispersed through the south-west province.	Likely	2013
Comesperma rhadinocarpum		P3	Grows on sandy soils, throughout the Eremaean Province and South-West Province.	Likely	1982
Conospermum undulatum	V	VU	Grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. The species is known from *Banksia* and jarrah/marri woodland, with a few records from slightly swampy habitat	Likely	2016
Cyanicula ixioides subsp. *ixioides*		P4	Lateric and gravel soils. Recorded in the Avon Wheatbelt, Jarrah Forest and SCP.	Unlikely	1985
Darwinia apiculata	E	EN	Lateritic soils.	Unlikely	2011
Dillwynia dillwynioides		P3	Species recorded between Gingin to Harvey, typically found on sandy soils and winter-wet depressions.	May	
Diplolaena andrewsii	E	EN	Known from granite outcrops and hillsides in the northern Jarrah Forest.	Unlikely	
Diuris drummondii	V	VU	Found in low-lying depressions in peaty and sandy clay swamps. Plants are frequently observed standing in several centimetres of water even during the summer flowering period	May	
Diuris micrantha	V	VU	Recorded between Perth and Boyup Brook growing in seasonally-wet flats amongst sedges and scattered shrubs.	May	
Diuris purdiei	E	EN	Recorded between Perth and Yarloop, growing under dense shrubs in seasonally-wet swamps and drainage lines (Brown *et al.,* 2013).	Likely	2007
Dodonaea hackettiana		P4		May	1981
Drakaea elastica	E	CR	Found on coastal plain between Ruabon and Cataby growing in sandy soil in *Banksia* woodlands and tall shrubs (Brown *et al.,* 2013).	Unlikely	2010
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.	Unlikely	
Drosera occidentalis		P4	Associated with wetlands.	Likely	1994
Eleocharis keigheryi	V	VU	Known from north of Eneabba and south-east of Qualeup. Grows in small clumps in a substrate of clay or sandy loam. It is emergent in freshwater creeks and transient waterbodies.	Likely	2011
Eremophila glabra subsp. *chlorella*	E	EN	Record near survey area was from a seasonal wetland associated with *Melaleuca viminea* and *M. acutifolia* Tall Open Scrub over *Gahnia trifida* and *Juncus kraussii* Very Open Sedgeland and weeds.	Likely	2014
Eriochilus sp. Roleystone (G. Brockman 1140)		P1		May	
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		P3	No habitat description. Swan Coastal Plain, from Gingin to Serpentine-Jarrahdale.	Likely	2009
Eryngium sp. Subdecumbens (G.J. Keighery 5390)		P3	No habitat description. Swan Coastal Plain, Gosnells and Swan.	Likely	2010
Eucalyptus x balanites	E	CE	Recorded on light coloured sandy soils over laterite including gently sloping heathlands, open mallee woodland over shrubland or heathland with emergent mallees. Known from two populations including one in Badgingarra National Park and one in the City of Armadale.	Unlikely	
Goodenia arthrotricha	E	EN	Gravel. Granite rocks, slopes.	Unlikely	2006
Grevillea curviloba subsp. *incurva*	E	EN	Confined to area between Muchea and Badgingarra. Grows in open heath in winter-wet areas on sand over limestone or over ironstone.	Unlikely	
Grevillea manglesii subsp. dissectifolia		P3	Gravelly loam, moist. Roadsides.	May	
Grevillea thelemanniana	CE	CR	Occurs on sandy clay soil in flat seasonally wet damplands. Limestone soils are associated with some of the sites. DBCA population 1 occurs near the survey area and is associated with Kenwick Swamp.	Likely	2012
Haemodorum loratum		P3	Grey or yellow sand and gravel.	Likely	2004
Halgania corymbosa		P3	Gravelly soils, soils over granite.	May	1999
Haloragis scoparia		P1	Brown, loamy soils supporting open woodland.	May	1901
Hibbertia montana		P4	Loam over granite, lateritic soils, gravel. Granite rocks, lateritic ridges & boulders, hills.	Unlikely	
Hydrocotyle lemnoides		P4	Associated with swamps.	Likely	2008
Hydrocotyle striata		P1	Clay. Springs.	Unlikely	1898
Isopogon drummondii Jacques		P3	No information available on WAH (1998-). Database results describe flats on grey brown sand with or without gravel in Banksia woodlands.	Likely	2006
Isotropis cuneifolia subsp. glabra		P3	Growns on sand and clay loam, associated with winter-wet flats.	Likely	2008
Jacksonia gracillima		P3	One known record in vicinity grown from winter damp flats. Grey-black sand.	Likely	2013
Jacksonia sericea		P4	Found in calcareous & sandy soils. Recorded between Wanneroo to Rockingham.	May	

Appendix A - Desktop Flora Assessment

Species	EPBC	WA	Habitat[1]	Likelihood of Occurrence	Count Date
Johnsonia pubescens subsp. cygnorum		P2	Species occurs in grey-white-yellow sand, on flats and seasonally wet sites. Recorded from South Perth to Murray.	May	
Lasiopetalum bracteatum		P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, and granite outcrops.	Likely	2016
Lasiopetalum glutinosum subsp. *glutinosum*		P3	No information available on WAH (1998-). One record nearby recorded on sandplain with Darling Scarp outwash in Banksia/Jarrah woodland.	Likely	1897
Lasiopetalum pterocarpum	E	CE	Occurs on slopes of Darling Range near Serpentine National Park. Occurs in riparian community with *Eucalyptus rudis*.	Unlikely	
Lepidosperma rostratum	E	EN	Restricted to two seasonally wet swamps including Kenwick Swamp near the survey area. Grows on peaty sand and clay amongst low heath in winter-wet swamps.	Likely	2017
Lepyrodia curvescens		P2	Species grows in sand and laterite, associated with seasonal sumplands.	Likely	2008
Levenhookia preissii		P1	Grey or black, peaty sand. Swamps.	Unlikely	1898
Macarthuria keigheryi	E	EN	White or grey sand. Records from north of Perth to Dandaragan.	Likely	2014
Meionectes tenuifolia		P3		May	1963
Melaleuca viminalis		P2	No habitat information available on WAH. Found in several IBRA regions in the south-west and north of WA.	Likely	2005
Myriophyllum echinatum		P3	Winter-wet clay-based depression, record from Kenwick Swamp.	Likely	2010
Ornduffia submersa		P4	No habitat information available. Species recorded throughout the south-west, from Gosnells to Armadale.	Likely	2007
Paracaleana sp. Laterite (G. Brockman GBB 3571)		P2		May	
Pimelea rara		P4	Lateritic soils.	Unlikely	1997
Pithocarpa corymbulosa		P3	Gravelly or sandy loam. Amongst granite outcrops.	Unlikely	1997
Platysace ramosissima		P3	Sandy soils.	May	2006
Ptilotus pyramidatus	CE	CR	Known from Kenwick area and Greater Brixton Street Wetlands. Inhabits seasonally inundated flat floodplain underlain by pale grey muddy-sand to sandy-mud alluvium of the Pinjarra Plain.	Likely	2010
Ptilotus sericostachyus subsp. roseus		P1		May	1906
Schoenus benthamii		P3	Found in white or grey sand and sandy clay. Associatated with winter-west flats and swamps.	Likely	1994
Schoenus capillifolius		P3	Semi-aquatic species, found in brown mud, claypans. Recorded between Gosnells to Waroona.	Likely	2009
Schoenus griffinianus		P4	White sand.	May	
Schoenus loliaceus		P2	Sandy soils. Winter-wet depressions.	May	2009
Schoenus natans		P4	Associated with winter-wet depressions, from the Geraldton Sandplains, Avon Wheatbelt, Swan Coastal Plain, Jarrah Forest and Warren.	Likely	2018
Schoenus pennisetis		P3	Species grows in grey or peaty sand and sandy clay. Associated with swampsand winter-wet depressions.	Likely	2007
Schoenus sp. Beaufort (G.J. Keighery 6291)		P1	Grows in mud and winter-wet claypans. Recorded in the Avon Wheatbelt and Swan Coastal Plain.	Likely	2009
Schoenus sp. Waroona (G.J. Keighery 12235)		P3	Grows in sandy clay to clay, in seasonal wetlands. Recorded in the Perth IBRA region.	Likely	1989
Scholtzia sp. Bickley (W.H. Loaring s.n. PERTH 06165184)				May	
Senecio gilbertii		P1		May	1994
Senecio leucoglossus		P4	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	Unlikely	1992
Sporobolus blakei		P3		May	
Stackhousia sp. Red-blotched corolla (A. Markey 911)		P3		May	1996
Stenanthemum sublineare		P2		May	2003
Stylidium aceratum		P3	Grows in sandy soils, in swamps. Recorded in Geraldton Sandplains, Jarrah Forest and Swan Coastal Plain IBRA region.	Likely	2013
Stylidium longitubum		P4	Species grows in sandy clay to clay, in seasonal wetlands. Recorded in the Geraldton Sandplains, Jarrah Forest, Swan Coastal Plain IBRA regions, between Dandaragan to Busselton.	Likely	2012
Stylidium paludicola		P3	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	May	
Stylidium periscelianthum		P3	Loamy clay, moist soils pockets. Wet flats, low granitic hills.	May	
Stylidium striatum		P4	Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	Unlikely	1897
Styphelia filifolia		P3	No habitat information available. Record near survey area from flats on brown-grey sand adjacent to Hartfield Golf Club.	Likely	2006
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. Associated with Kenwick Swamp.	Likely	2010
Synaphea sp. Serpentine (G.R. Brand 103)	CE	CR	Flat terrain on grey-brown sandy loams to clay in seasonally wet areas.	May	
Tetraria australiensis			Grey sand over clay; also described as yellow and sandy or clayey lateritic soils	May	1898
Thelymitra dedmaniarum	E	CR	Recorded near Gidgegannup in Darling Range on granite slopes and in open Wandoo woodland.	Unlikely	
Thelymitra magnifica		P1	Stony ridges. Recorded on edge of Darling Scarp amongst dense heath in rocky soils surrounding exposed granite outcrops (Brown *et al.* , 2013). DBCA population 1, 3, 4, 5 and 8 are in close proximity.	Unlikely	2017

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Species	EPBC	WA	Habitat[1]	Likelihood of Occurrence	Count Date
Thelymitra stellata	E	EN	Sand, gravel, lateritic loam. Grows in *Eucalyptus marginata* forests or in low heath on rocky tops of small hills (Brown *et al.* , 2013). DBCA population 4 and 24 in close proximity.	Likely	1994
Thysanotus anceps		P3	White or grey sand, lateritic gravel, laterite.	Likely	1997
Thysanotus sp. Badgingarra (E.A. Griffin 2511)		P2	Grey sand with lateritic gravel.	Unlikely	2014
Tripterococcus sp. Brachylobus (A.S. George 14234)		P4		May	1980
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 (George, 2002). Frequently in association with a few other verticordias in heath, shrubland and open woodland (George, 2002). Records from 1990 and 1994.	Likely	2007

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Acanthophis antarcticus	Southern Death Adder	P3	-			-	The Southern Death Adder is associated with forests, woodlands, grasslands or heath. Populations in WA are scattered in the south-west (ALA 2019)	Unlikely to occur within the survey area - no recent records.
Actitis hypoleucos	Common Sandpiper	IA	Marine / Migratory	1976	1	+	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 - no recent records and no preferred habitat likely to be present
Anous tenuirostris melanops	Australian Lesser Noddy	EN	V	1988	1	+	The Australian Lesser Noddy is a small dark-plumaged Noddy, standing at approximately 34 cm and a wingspan of 60 cm (Pizzey & Knight, 2007). This species breeds on the Abrolhos Islands and is sedentary however sometimes beach washed south to Cape Naturaliste, where, where it nests in mangroves (Pizzey & Knight, 2007, Johnstone & Storr, 1998, Higgins & Davies, 1996). Individuals recorded on the mainland have typically been dying or dead after washing up from large storms (Johnstone & Storr, 1998).	Unlikely to occur - no recent records and no preferred habitat likely to be present
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 - no recent records and no preferred habitat likely to be present
Australotomurus morbidus	Cemetery Springtail, Guildford Springtail	P3	-	1993	5	-	The cemetery sprintail has only be found in 4 populations on the Swan Coastal Plain in heavily disturbed areas. The genus typically is found in long undisturbed native grasses and heathlands.	Unlikely to occur due to habitat not being present within the study area and observations occuring near the survey area.
Bettongia penicillata ogilbyi	Woylie	CR	E	1988	1	+	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 - no recent records and no preferred habitat likely to be present
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,	Unlikely to occur - no recent records and no preferred habitat likely to be present
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 - no recent records and no preferred habitat likely to be
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 - no recent records and no preferred habitat likely to be
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 - no recent records and no preferred habitat likely to be present

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	V	2018	17	+	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 - abundant recent observations and suitable habitat likely to present
Calyptorhynchus baudinii	Baudin's Cockatoo	EN	E	2015	5	+	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).	May occur - no DBCA records in close proximity in DBCA supplied search, but other records in close proximity.
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	E	2013	605	+	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	Likely to occur - abundant recent observations and suitable habitat likely to present
Ctenotus delli	Dell's skink, Darling Range southwest Ctenotus	P4	-			-	No habitat description	Unlikely to occur - no recent records and no preferred habitat likely to be
Ctenotus ora	Coastal Plains Skink	P3	-			-	The Coastal Plains Skins has been recorded in low numbers in a small stetch of the SCP south of Perth, between Dunsborough and Mandurah (ALA 2019). This species is found in open Eucalypt and Banksia woodland on sandy coastal plain and coastal heath.	Unlikely to occur - no recent records and no preferred habitat likely to be
Dasyurus geoffroii	Chuditch	VU	V	2003	12	+	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.	Unlikely occur - a number of observation near the survey area, however no preferred habitat likely to be present within the Survey Area.
Diomedea amsterdamensis	Amsterdam Albatross	CR	E			+	The Amsterdam Albatross is a huge, full-bodied albatross with extremely long wings (wing span 2.5–3.5 m) and a short, wedge-shaped tail. The bill is very large and pink, with a bulbous tip (Marchant & Higgins 1990). The Amsterdam Albatross is a non-resident visitor to Australia, and may occur in south-west and south Australian waters (Pizzey & Knight 1999).	Unlikely to occur - no recent records and no preferred habitat likely to be present

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Diomedea epomophora	Southern Royal Albatross	VU	V			+	The Southern Royal Albatross ranges across the coastal waters of the southern coast of Australia (DotEE, 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be
Diomedea exulans	Gibson's Albatross	VU	V			+	Gibson's Albatross is very similar to the Wandering Albatross in appearance. Adults have a white or pale back that extends along the dorsal surface of the wings near the body (Pizzey & Knight 1999). There are no breeding colonies of Gibson's Albatross in Australian territory (Garnett & Crowley 2000).	Unlikely to occur - no recent records and no preferred habitat likely to be
Diomedea sanfordi	Northern Royal Albatross	EN	E			+	The Northern Royal Albatross ranges throughout the coastal waters of the southern coast of Australia (DotEE, 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be
Glossurocolletes bilobatus	a short-tongued bee (southwest)	P2	-	1981		-	Leioproctus (Glossurocolletes) bilobatus, family Colletidae, is associated with Jarrah/Wandoo Forest nominally off the Swan Coastal Plain. Collections have been made from as far east as Christmas Tree Well off Brookton Highway and on the South Coast within the Stirling Ranges (Terry Houston pers. comm. to C. O'Neill, 08/2010). Leioproctus (Glossurocolletes) bilobatus has so far been collected solely from the yellow flowering pea, Gompholobium aristatum.	Unlikely to occur - due to degraded vegetation within study area not supporting the associated flora species
Isoodon fusciventer	Quenda, southwestern brown bandicoot	P4	-	2018	148	-	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 - abundant recent observations and suitable habitat likely to present
Ixobrychus dubius	Australian Little Bittern	P4	-			-	The Australian Little Bittern is associatied with freshwater bodies and wetlands, typically inhabitting dense vegetation (reeds and sedges). The species have also been recorded in brackish and saliine wetlands, such as mangrove swamps. In WA the birds are locally common on the SCP and have scattered records in the Kimberley (ALA 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be
Leioproctus douglasiellus	a short-tongued bee	EN	CE	2006	4	+	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 - associated flora species habitat not present within the study area.
Leipoa ocellata	Malleefowl	VU	V			+	The Malleefowl is a large, ground-dwellin gbird 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 - no recent records and no preferred habitat likely to be present
Lerista lineata	Perth Slider, Lined Skink	P3	-	1975	4	-	Found in the lower west coast from north of Perth south to Leschenault Peninsula/Kemerton. Found in the southern suburbs of Perth. This species inhabits white sands under areas of shrubs and heath where it inhabits loose soil and leaf litter particularly in association with Banksias.	Unlikely to occur - no recent records and no preferred habitat likely to be
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.	Unlikely to occur - no DBCA records and limited available habitat
Macronectes halli	Northern Giant-Petrel	-	V			+	Northern Giant-Petrel is a dark large seabird, with a wingspan of 1.5-2.1 m and a large straw coloured bill. Similar in appearance to the South Giant-Petrel and hybrids of both species exist (Pizzey & Knight, 2007). The species typically frequents oceans, bays, seas, islands and mainland coastal areas. The speices visits areas off the Australian mainland mainly during the winter months (May-October). Immature and some adult birds are commonly seen during this period in offshore and inshore waters from around Fremantle (WA) (Pizzey & Knight, 2007).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Myrmecobius fasciatus	Numbat	EN	E	1974	1	-	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 - no recent records and no preferred habitat likely to be

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Neelaps calonotos	Black-striped Snake, black-striped burrowing snake	P3	-	1975	4	-	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 - no recent records in or adjacent survey area
Notamacropus irma	Western Brush Wallaby	P4	-	1976	2	-	The western brush wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest.	May occur - suitable habitat likely to be present
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 Eightly Mile Beach (Bamford et al., 2008).	Unlikely to occur - no recent records and no preferred habitat likely to be present
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	Unlikely to occur - no recent records and no preferred habitat likely to be present
Pachyptila turtur subantarctica	Fairy Prion (southern)	-	V			+	The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia, with the species a visitor to the south-west coast of Western Australia (DotEE, 2019).	Unlikely to occur - no recent records in or adjacent survey area
Pandion haliaetus	Osprey	IA	Marine / Migratory			+	The breeding range of the Osprey includes the northern coast of Australia from Albany in WA to Lake Macquirie in NSW. This bird is moderately common in Australia, mostly in northern Australia. It is rare to uncommon in southern WA. The Osprey inhabits 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 (DotEE, 2018).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Phascogale tapoatafa subsp. *wambenger*	South-western Brush-tailed Phascogale	CD	-	1997	2	-	Species recorded in the south-west of WA. No habitat description available.	Unlikely to occur - no recent records in survey area
Pseudemydura umbrina	Western Swamp Tortoise	CR	CE	2013	4	-	The Western Swamp Tortoise is a brown turtle growing up to 150 mm in length with a squarish shell, flat and broad lower shell and a broad, flat head with a horny casque (helmet) (Cogger, 2000). The Western Swamp Tortoise has a very small geographic range. The species has only been recorded from scattered localities in a narrow strip (3–5 km wide) of the Swan Coastal Plain, roughly parallel with the Darling Range (Burbidge & Kuchling, 2004). Currently, the Ellen Brook Nature Reserve population is the only viable, naturally occurring population in the wild. The Twin Swamps Nature Reserve and Mogumber Nature Reserve populations are maintained with translocated individuals	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 - no recent records in or adjacent survey area
Puffinus pacificus	Wedge-tailed Shearwater	IA	Marine / Migratory			-	The Wedge-tailed Shearwater breeds on the east and west coasts of Asutralia, and on off-shore islands. The species is a pelagic, marine bird (DotEE, 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Rostratula australis	Australian Painted Snipe	-	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 - no recent records and no preferred habitat likely to be present
Setonix brachyurus	Quokka	VU	V			+	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,	Unlikely to occur - no recent records and is now thought to be absent from
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, occuring as far north as the Dampier Archipelago. The Fairy Tern nests on sheltered sandy beaches, spits and banks (DotE, 2015).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Thalassarche cauta cauta	Shy Albatross	VU	V			+	The Shy Albatross has a predominantly white body with dark grey wings and back. The species has a grey bill with a yellow tip and has a wingspan up to 2.6 m. The Shy Albatross occurs widely throughout the southern oceans, and breed of islands in Australia and New Zealand. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia (Wood 1992, Marchant & Higgins 1990).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Thalassarche cauta steadi	White-capped Albatross	VU	V			+	The White Capped Albatross is widespread throughout the southern coast of Australia, and more commonly on the south east coast. Breeding coloies occur on islands south of New Zealand (Double et al. 2003)..	Unlikely to occur - no recent records and no preferred habitat likely to be
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	VU	V			+	The Campell Albatross is a non-breeding visitor to the coast of Australia. The species is more commonly found foraging over the oceanic continental slopes off Tasmania, Victoria and New South Wales (EA 2001f).	Unlikely to occur - no recent records and no preferred habitat likely to be
Thalassarche melanophris	Grey-headed Albatross	EN	V			+	The Black-Browed Albatross is 80-95 cm in length, with a wingspan up to 250 cm. Adults are white with dark-brown irides, an orange-yellow bill, a black brow and bluish-grey legs (Marchant & Higgins 1990).	Unlikely to occur - no recent records and no preferred habitat likely to be
Thalasseus bergii	Crested Tern	IA	Marine / Migratory			-	This large tern is predominantly found offshore and coastal, on beaches, bays, inlets, tidal rivers, salt swamps, lakes and larger rivers (Pizzey & Knight, 2010).The Crested Tern is usually a strictly coastal species, though there are occasional records in the arid interior of Australia, where birds were possibly blown by passing tropical cyclones (Birdlife Australia, 2018).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Tringa glareola	Wood Sandpiper	IA	Marine / Migratory	1959	1	+	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 - no recent records and no preferred habitat likely to be
Tringa nebularia	Common Greenshank	IA	Marine / Migratory	2002	5	+	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 - no recent records and no preferred habitat likely to be
Tringa stagnatilis	Marsh Sandpiper	IA	Marine / Migratory	1977	1	-	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 - no recent records and no preferred habitat likely to be present

Appendix A - Desktop Fauna Assessment

Scientific Name	Common Name	Conservation Status		DBCA		PMST	Ecology	Likelihood of Occurrence
		State	Federal	Last Record	Total Records			
Tyto novaehollandiae subsp. *novaehollandiae*	Masked Owl (southwest)	IA	Marine / Migratory			-	The Masked Owl occupies a variety of habitats including forests, open woodlands, farmlands with large trees, paperbark woodlands and caves. This species generally occurs in coastal mainland Australia and though widespread it is typically locally uncommon (Pizzey & Knight, 2007).	May occur - no DBCA records in close proximity in DBCA supplied search, but other records in close proximity. Suitable habitat likely present
Westralunio carteri	Carter's Freshwater Mussel	VU	V	2012	6	-	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 - a number of observation near the survey area, suitable habtiat may be present

Appendix B

Flora by Family by Community Matrix

Appendix B Flora by Family by Community Matrix

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Family		Taxon	CcHtWm	CcMvAv	CpHaWm	MrApWm
Anthericaceae						
		Anarthria laevis		x		
		Tricoryne elatior		x		
Asteraceae						
	*	*Ursinia anthemoides*		x	x	
Casuarinaceae						
		Casuarina obesa				x
Colchicaceae						
		Burchardia congesta			x	
Crassulaceae						
		Crassula colorata			x	
Cupressaceae						
		Callitris pyramidalis		x	x	
Cyperaceae						
		Mesomelaena pseudostygia			x	
		Schoenus bifidus			x	
		Schoenus flexuosus			x	
Fabaceae						
		Acacia drewiana subsp. *drewiana*			x	
		Acacia pulchella var. *pulchella*	x	x		x
		Acacia saligna			x	
	*	*Chamaecytisus palmensis*	x			
		Daviesia physodes			x	
		Gompholobium tomentosum		x		
		Jacksonia furcellata		x	x	
		Jacksonia sternbergiana				x
	*	*Lotus angustissimus*		x		
Goodeniaceae						
		Goodenia pulchella subsp. Coastal Plain B			x	
Haemodoraceae						
		Haemodorum spicatum		x		
Iridaceae						
	*	*Watsonia meriana*	x	x	x	x
Lauraceae						
		Cassytha racemosa			x	
Myrtaceae						
		Chamelaucium uncinatum				x
		Corymbia calophylla	x	x		x
		Eremaea pauciflora			x	
		Eucalyptus rudis	x			x
		Eucalyptus terracina			x	
		Hypocalymma angustifolium			x	
		Melaleuca rhaphiophylla	x	x	x	x
		Melaleuca seriata			x	
		Melaleuca viminea Lindl. subsp. *Viminea*		x	x	
		Verticordia densiflora var. *densiflora*			x	

Appendix B Flora by Family by Community Matrix

Family		Taxon	CcHtWm	CcMvAv	CpHaWm	MrApWm
Papaveraceae						
	*	*Fumaria capreolata*				x
Poaceae						
	*	*Avena barbata*		x		x
	*	*Bambusoideae*	x			
	*	*Briza maxima*		x	x	x
	*	*Briza minor*			x	
	*	*Ehrharta calycina*	x		x	
	*	*Lolium multiflorum*		x		
	*	*Polypogon monspeliensis*	x			x
	*	*Stenotaphrum secundatum*				x
Poaceae						
	*	*Eragrostis curvula*				x
Proteaceae						
		Banksia telmatiaea			x	
		Hakea trifurcata	x			
Restionaceae						
		Chaetanthus aristatus			x	
		Hypolaena exsulca			x	
	*	*Lyginia imberbis*			x	
	*	*Lyginia imberbis*			x	
Rhamnaceae						
		Trymalium odoratissimum				x
Stylidiaceae						
		Stylidium dichotomum			x	
Thymeleaceae						
		Pimelea sp.			x	
Xanthorrhoeaceae						
		Xanthorrhoea preissii		x		

Appendix C

Flora Quadrat Data

Appendix C Flora Quadrat Data

Appendix C Quadrat Data

Site: 1	**Location:** -32.007202 115.989967	**Date:** 06-11-2019
Type: Releve	**Size:** 10X10	**Community:** MrApWm
Topography: Creek	**Soils:**	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Completely Degraded, weeds, escaped garden plants		

*	Taxon	Height cm	Foliage %
	Acacia pulchella var. *pulchella*	300	4
	Casuarina obesa	600	5
	Corymbia calophylla	1800	10
	Eucalyptus rudis	1500	10
*	*Briza maxima*	20	2

*	Taxon	Height cm	Foliage %
*	*Eragrostis curvula*	50	10
*	*Fumaria capreolata*	10	1
	Melaleuca rhaphiophylla	400	2
*	*Polypogon monspeliensis*	50	1
*	*Stenotaphrum secundatum*	30	50
*	*Watsonia meriana*	30	1
	Trymalium odoratissimum	100	1
*	Weeds	20	20

Note: * depicts an introduced (weed) species

Site: 2	Location: --32.007098 115.989688	Date: 06-11-2019
Type: Releve	**Size:** 10X10	**Community:** CcHtWm
Topography: Flat	**Soils:** Sand	**Colour:** Grey
Bare Ground:	**Fire:** 10+	
Vegetation significance: NA		
Condition: Degraded, Watsonia infestation		

*	Taxon	Height cm	Foliage %	Comments
	Corymbia calophylla	1500	20	saplings mostly
	Hakea trifurcata	300	30	
*	*Ehrharta calycina*	100	2	
*	*Watsonia meriana*	50	80	

Note: * depicts an introduced (weed) species

Site: 3	Location: --32.007511 115.989081	Date: 06-11-2019
Type: Releve	**Size:** 10X10	**Community:** MrApWm
Topography: Creek	**Soils:**	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Completely Degraded		

*	Taxon	Height cm	Foliage %
*	*Avena barbata*	100	3
	Chamelaucium uncinatum	200	1
*	*Eragrostis curvula*	100	2
	Eucalyptus rudis	1300	5
	Jacksonia sternbergiana	350	2
	Trymalium odoratissimum	150	2
*	*Watsonia meriana*	100	80

Note: * depicts an introduced (weed) species

Site: 4	Location: -32.007832 115.988487	Date: 06-11-2019
Type: Quadrat	**Size:** 10X10	**Community:** CcHtWm
Topography:	**Soils:**	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Completely Degraded		

*	Taxon	Height cm	Foliage %
	Acacia pulchella var. *pulchella*	200	1
*	*Bambusoideae*	400	1
*	*Chamaecytisus palmensis*	200	2
	Eucalyptus rudis	1600	4
	Melaleuca rhaphiophylla	400	5
*	*Polypogon monspeliensis*	150	3
*	*Watsonia meriana*	100	90

Note: * depicts an introduced (weed) species

Site: 5	Location: -32.007202 115.989967	Date: 06-11-2019
Type: Quadrat	**Size:** 10X10	**Community:** CpHaWm
Topography: Lower Slope	**Soils:** Sand	**Colour:**
Bare Ground: 5% small litter	**Fire:** 10+	
Vegetation significance: NA		
Condition: Very Good, watsonia, partial clearing		

*	Taxon	Height cm	Foliage %
	Acacia drewiana subsp. *drewiana*	30	1
	Banksia telmatiaea	80	2
*	*Briza maxima*	15	0.5
	Burchardia congesta	15	0.1
	Callitris pyramidalis	180	4
	Cassytha racemosa	cl	0.1
	Chaetanthus aristatus	20	0.5
	Crassula colorata	5	0.1

*	Taxon	Height cm	Foliage %
	Daviesia physodes	100	3
*	*Ehrharta calycina*	60	2
	Eremaea pauciflora	80	4
	Eucalyptus terracina		
	Goodenia pulchella subsp. Coastal Plain B	10	0.1
	Hypocalymma angustifolium	100	35
	Hypolaena exsulca	20	1
	Jacksonia furcellata		
*	*Lyginia imberbis*	30	0.3
*	*Lyginia imberbis*	20	0.5
	Melaleuca rhaphiophylla	300	5
	Melaleuca seriata	60	2
	Melaleuca viminea Lindl. subsp. *Viminea*	200	4
	Mesomelaena pseudostygia	30	0.2
	Pimelea sp.	15	0.1
	Schoenus bifidus	10	0.1
	Schoenus flexuosus		
	Stylidium dichotomum	10	0.5
*	*Ursinia anthemoides*	10	0.2
	Verticordia densiflora var. *densiflora*	50	1
*	*Watsonia meriana*	50	2

Note: * depicts an introduced (weed) species

Site: 6	Location: -32.008533 115.989371	Date: 06-11-2019
Type: Releve	Size: 10X10	Community: CcXpWm
Topography:	Soils:	Colour:
Bare Ground:	Fire:	
Vegetation significance: NA		
Condition: Degraded		

*	Taxon	Height cm	Foliage %
	Corymbia calophylla	1200	
	Gompholobium tomentosum		
*	*Watsonia meriana*	100	
	Xanthorrhoea preissii	80	

Note: * depicts an introduced (weed) species

Site: 7	Location: -32.008185 115.989317	Date: 06-11-2019
Type: Releve	**Size:** 10X10	**Community:** CpHaWm
Topography: Flat	**Soils:** Sand	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Swgraded, clearing, weeds		

*	Taxon	Height cm	Foliage %
*	*Avena barbata*	100	50
*	*Lolium multiflorum*	100	10
*	*Lotus angustissimus*	10	30
	Melaleuca rhaphiophylla	300	2
	Melaleuca viminea Lindl. subsp. *Viminea*	250	25
*	*Watsonia meriana*	60	5

Note: * depicts an introduced (weed) species

Site: 8	Location: -32.007697 115.989862	Date: 06-11-2019
Type: Releve	**Size:** 10X10	**Community: C**pHaWm
Topography: Flat	**Soils:** Sand	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Degraded, Watsonia, cleared		

*	Taxon	Height cm	Foliage %
	Acacia pulchella var. *pulchella*		
	Anarthria laevis	50	1
*	*Briza maxima*		
	Callitris pyramidalis	200	4
	Haemodorum spicatum	80	0.1
	Jacksonia furcellata		
	Tricoryne elatior		
*	*Ursinia anthemoides*		

*	Taxon	Height cm	Foliage %
*	*Watsonia meriana*	50	80

Note: * depicts an introduced (weed) species

Site: 9	Location: -32.010266 115.986094	Date: 06-11-2019
Type: Releve	**Size:** 10X10	**Community:** MrApWm
Topography: Creek	**Soils:**	**Colour:**
Bare Ground:	**Fire:**	
Vegetation significance: NA		
Condition: Degraded, weeds, clearing		

*	Taxon	Height cm	Foliage %
*	*Avena barbata*	80	1
	Eucalyptus rudis	600	5
*	*Fumaria capreolata*	30	1
	Jacksonia sternbergiana	400	2
	Melaleuca rhaphiophylla	500	20
*	*Polypogon monspeliensis*	100	40
*	*Watsonia meriana*	100	25

Note: * depicts an introduced (weed) species

Appendix D

Black Cockatoo Foraging Assessments

Appendix D Black Cockatoo Foraging Assessments

Appendix E - Black Cockatoo Foraging Habitat Assessments

Fauna Habitat Assessment No.	Fauna Habitat (actually broad veg unit at this stage)	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
MKSEA3	heath	1	3	0	0	0	0	0	0	-2	-1	0	0	1	Degraded heath containing occasional scattered foraging plants within the known foraging area. Habitat does not contain breeding or potential breeding trees. No foraging evidence recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
UniqueID17	Scattered Riparian Trees	1	3	0	0	2	0	0	0	-2	-1	0	-1	2	Scattered *Eucalyptus rudis* , paperbark and introduced eucs within the known foraging area. *E.rudis* were either diseased or potentially impacted by changing water tables. Contains occasional potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
MKSEA1	Drainage Line	1	3	0	0	2	0	0	0	-2	-1	0	0	3	Highly degraded drainage line containing scattered *Eucalyptus rudis* with the occasional Marri on the SCP. Habitat contains potential breeding trees. No foraging evidence recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
UniqueID21	Scattered Riparian Trees with Breeding Potential	1	3	3	0	2	0	0	0	-2	-1	0	-1	5	Scattered *Eucalyptus rudis* , paperbark and introduced eucs within the known foraging area. *E.rudis* were either diseased or potentially impacted by changing water tables. Contains occasional potential breeding trees and one breeding tree. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
UniqueID1	Cleared	1	3	0	0	0	0	0	0	-2	-1	0	0	1	Predominantly cleared paddocks with occasional isolated foraging plants within the know foraging area. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. No breeding activity within 12km, and <2km from a watering point.
UniqueID5	Scattered trees	5	3	0	0	0	0	0	0	-2	-1	0	0	5	Scattered predominantly introduced mature eucalypts within the known foraging area. Does no contain breeding or potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
90	open woodland	5	3	0	0	2	0	0	0	-2	-1	0	0	7	Small patch of open woodland within foraging area containing occasional foraging plants. Contains potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.
80	Scattered Trees	5	3	0	0	0	0	0	0	-2	-1	0	-1	4	Scattered trees comprising foraging species, including introduced and native eucalypts, *Agonis flexuosa* and Cape Lilac within known foraging area. Does not contain potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed Birdlife (2018) white-tailed roost site. Breeding activity unlikely within 12km, <2km from a watering point.

Appendix E - Black Cockatoo Foraging Habitat Assessments

Fauna Habitat Assessment No.	Fauna Habitat (actually broad veg unit at this stage)	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
MKSEA3	Heath	1	3	0	0	0	0	-2	0	0	0	0	0	**2**	Degraded heath containing occasional scattered foraging plants on the SCP. Habitat does not contain breeding and potential breeding trees. No foraging evidence recorded, Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
UniqueID17	Scattered Riparian Trees	1	3	0	0	2	0	-2	0	0	0	0	-1	**3**	Scattered *Eucalyptus rudis* , paperbark and introduced eucs on the SCP. *E.rudis* were either diseased or potentially impacted by changing water tables. Contains occasional potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
MKSEA1	Drainage Line	1	3	0	0	2	0	-2	0	0	0	0	0	**4**	Highly degraded drainage line containing scattered *Eucalyptus rudis* with the occasional Marri on the SCP. Habitat contains potential breeding trees. No foraging evidence recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
90	open woodland	5	3	0	0	2	0	-2	0	0	0	0	0	**8**	Small patch of open woodland on SCP containing occasional foraging species. Contains potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
UniqueID1	Cleared	1	3	0	0	0	0	-2	0	0	0	0	0	**2**	Predominantly cleared paddocks with occasional isolated foraging plant on the SCP. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
UniqueID 5	Scattered Trees	5	3	0	0	0	0	-2	0	0	0	0	0	**6**	Scattered predominantly introduced mature eucalypts on the SCP. Does not contain breeding or potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
UniqueID21	Scattered Riparian Trees with Breeding Potential	1	3	3	0	2	0	-2	0	0	0	0	-1	**6**	on the SCP. *E.rudis* were either diseased or potentially impacted by changing water tables. Contains occasional potential breeding trees and one breeding tree. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
80	Scattered Trees	5	3	0	0	0	0	-2	0	0	0	0	-1	**5**	Scattered trees comprising foraging species, including introduced and native eucalypts, *Agonis flexuosa* and Cape Lilac on the SCP. Contains potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed DBCA roost site. Breeding activity confirmed within 12km, and <2km from a watering point.

Appendix E - Black Cockatoo Foraging Habitat Assessments

Fauna Habitat	Fauna Habitat Assessment UniqueID	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
Heath	MKSEA3	0												**0**	Heath containing no foraging plants.
Drainage Line	MKSEA1	1	0	0	0	2	0	0	0	-2	0	0	0	**1**	Highly degraded drainage line containing occasional Marri. Habitat contains potential breeding trees. Foraging evidence not recorded. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
Scattered Riparian Trees with Breeding Potential	UniqueID21	1	0	3	0	2	0	0	0	-2	0	0	-1	**3**	Scattered *Eucalyptus rudis* , paperbark and introduced eucs. E.rudis were either diseased or potentially impacted by changing water tables. Contains occasional potential breeding or breeding trees. Foraging evidence not recorded. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
Open Woodland	90	1	0	0	0	2	0	0	0	0	0	0	0	**3**	Small patch of open woodland containing foraging species that are not dominant. Foraging evidence recorded. Contains potential breeding trees. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
Scattered Riparian Trees	UniqueID17	1	0	0	0	2	0	0	0	-2	0	0	-1	**0**	Scattered trees containing occasional introduced eucalytp. Contains occasional potential breeding trees. E.rudis were either diseased or potentially impacted by changing water tables. Foraging evidence not recorded. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
Scattered Trees	UniqueID5	5	0	0	0	0	0	0	0	-2	0	0	0	**3**	Scattered predominantly introduced mature eucalypts. Does not contain potential or breeding breeding trees. Foraging evidence not recorded. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.
Scattered Trees	80	1	0	0	0	0	0	0	0	0	0	0	0	**1**	Scattered trees containing occasional introduced eucalypt and Cape Lilac. Does not contain potential breeding trees. Foraging evidence recorded adjacent. Within 12 km of confirmed roost site. Breeding activity confirmed within 12km, and <2km from a watering point.

Appendix E

Floristic Community Type Assessment Output

Appendix E Floristic Community Type Assessment Output

		Project Quadrat
SCP Quadrats		5
	50	13%
	500	10%
4M01		10%
4M02		6%
4M03		3%
4M04		4%
5A01		15%
5C01		3%
5C02		9%
5C03		18%
5C04		5%
5C05		0%
5C06		8%
5C07		12%
5D01		12%
5F01		17%
5G01		10%
AA_5		100%
activ01		12%
activ02		8%
activ03		9%
ACTON-1		2%
airf01		9%
airf02		6%
alfr01		0%
alfr02		9%
AMBR-1		7%
AMBR-2		6%
AMBR-3		7%
AMBR-4		7%
AMBR-5		5%
AMBR-6		4%
AMBR-7		7%
AMBR-9		8%
AMBRAL-1		9%
APBF-1		8%
APBF-2		6%
AUSTB-1		4%
AUSTB-2		3%
AUSTB-3		0%
AUSTB-4		10%
AUSTB-5		11%
AUSTB-6		10%
AUSTB-7		5%
AUSTB-8		7%
AUSTRA-1		10%
BAMBUN-1		15%
BAMBUN-2		4%
BAMBUN-3		9%
BANK-1		14%
BANK-2		9%
BANK-3		11%
BC1		5%
BC2		2%
BC3		7%
BC4		6%
BC5		4%
BC6		5%
BC7		3%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
beel01	9%
beel02	5%
beel03	3%
benn01	4%
benn02	4%
benn03	8%
bibra01	15%
BMaid02	4%
BNR01	13%
BNR02	11%
BNR03	9%
BNR04	10%
BNR05	7%
BNR06	5%
BNR07	6%
BNR08	4%
BNR09	0%
BNR10	0%
BNR11	0%
BNR12	0%
BNR13	4%
BNR14	5%
BNR15	0%
BNR16	0%
BNR17	0%
BNR18	11%
BNR19	5%
BNR20	11%
BNR21	3%
BNR22	0%
BNR23	6%
BNR24	3%
BNR25	0%
BNR26	9%
BNR27	17%
BNR28	6%
BNR29	3%
BNR30	6%
BNR31	10%
BNR32	7%
BNR33	8%
bold05	0%
bold06	0%
bold07	8%
bold08	0%
bold09	12%
BOLD-1	11%
bold10	13%
bold11	7%
bold12	10%
bold13	9%
bold14	10%
bold16	8%
bold17	12%
bold18	0%
BOLD-2	10%
bold21	0%
bold22	0%
bold23	12%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
BOLD-3	5%
BOLD-4	6%
boot01	6%
boot02	4%
boot03	8%
boyan 01	6%
boyan 02	0%
brick1	11%
brick2	4%
brick3	4%
brick4	7%
brick5	9%
brick6	5%
brick7	12%
brick8	11%
BRIX-1	11%
BRIX-2	13%
BRIX-3	11%
BRIX-4	0%
BRIX-5	11%
BU01	3%
BU02	3%
BU03	4%
BU04	4%
buck01	0%
buffer01	2%
BULL-1	10%
BULL-10	11%
BULL-11	7%
BULL-12	7%
BULL-3	12%
BULL-4	8%
BULL-5	21%
BULL-6	9%
BULL-7	24%
BULL-8	11%
BULL-9	7%
BULLER-1	3%
BULLER-2	9%
BULLER-3	12%
bunb01	10%
BURN-1	3%
BURN-2	7%
BURNRD01	6%
BURNRD02	5%
Bushm01	12%
Bushm02	10%
BW01	9%
BW02	12%
BW03	0%
BW04	11%
BW05	7%
BYRD-1	9%
C 97PU.R	4%
C 98PU.R	9%
C 99PU.R	12%
C58-1	15%
C58-2	10%
C58-3	8%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
C58-4	11%
C71-1	7%
C71-2	8%
C71-3	7%
C71-4	5%
CAPEL-1	7%
CAPEL-2	8%
CAPEL-3	6%
CAPEL-4	0%
CAPEL-5	9%
CAPEL-6	6%
CAPEL-7	10%
CAPEL-8	11%
CAPEL-9	7%
CARAB-1	4%
CARAB-2	8%
CARAB-3	3%
CARB-1	3%
CARB-2	6%
CARB-3	8%
CARB-4	3%
card1	7%
card10	14%
card11	19%
card12	9%
card13	11%
card2	10%
card3	13%
card4	22%
card5	9%
card6	9%
card7	6%
card8	11%
card9	12%
cas01	7%
cas02	9%
cas03	12%
cas04	13%
Cavs01	8%
Cavs02	16%
Cavs06	8%
Cavs07	14%
Cavs09	6%
Cavs10	8%
Cavs11	18%
CH049CUL	7%
CH050CUL	0%
CH054ASH	8%
CH055ASH	3%
CH056ASH	0%
CH057ASH	3%
CH058ASH	6%
CH059ASH	0%
CH060ASH	3%
CH156TEE	4%
CH157TEE	6%
Chid06	5%
CHIDPT-1	3%
CLIFT01	4%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
CLIFT02	2%
CLIFT03	3%
colriv01	12%
cool 01	10%
cool 02	3%
cool 03	4%
cool 04	4%
cool 08	6%
cool 09	0%
cool 11	4%
cool14	0%
cool15	0%
CORON-1	7%
CORON-2	7%
CRAMPT-1	7%
CRAMPT-2	9%
Cresw01	9%
dard01	4%
dard02	13%
dard03	2%
DEJONG01	3%
DEJONG02	11%
Della01	14%
DEPOT-1	8%
dian01	10%
dian02	16%
dillo01	5%
DRAIN-1	11%
DUCK-1	6%
DUCK-2	6%
DUCK-3	3%
DUNS-1	6%
elbr01	6%
elbr02	0%
elbr03	5%
ELDO-1	5%
ELE01	16%
ELE02	6%
ELE03	15%
ELE04	16%
ELE05	15%
ELE06	14%
ELE07	13%
ELE08	8%
ELE09	0%
ELE10	0%
ELE11	16%
ELE12	13%
ELE13	8%
ELE14	12%
ELE15	13%
ELE16	5%
ELE17	9%
ELE18	12%
ELE19	0%
ELE20	0%
ELE21	8%
ELE22	10%
ELE23	5%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
ELE24	8%
ELE25	8%
ELE26	9%
ELE27	4%
ELE28	10%
ELE29	11%
ELE30	5%
ELE31	13%
ELE32	11%
ELE33	10%
ELE34	5%
ELE35	0%
ELE36	0%
ELE37	5%
ELE38	17%
ELE39	13%
ELE40	15%
ELLEN-1	5%
ELLEN-2	7%
ELLEN-3	5%
ELLEN-4	3%
ELLEN-5	14%
ELLEN-6	14%
ELLEN-7	15%
Ellib01	5%
Ellib02	3%
Ellib03	6%
Ellib04	8%
Ellib05	5%
Ellib06	9%
ELLIS-1	10%
ELLIS-2	2%
ELLIS-3	8%
FISH-1	2%
FISH-2	6%
FISH-3	6%
FISH-4	4%
FISH-5	0%
FL-1	11%
FL-10	9%
FL-2	7%
FL-3	7%
FL-4	13%
FL-5	11%
FL-6	15%
FL-7	11%
FL-9	9%
FYR01	8%
FYR02	5%
FYR03	3%
GARD01	0%
GARD02	3%
GARD03	0%
GARD04	0%
gelor01	4%
gelor02	5%
gibson01	4%
gibson02	4%
gill01	11%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
GINGIN-1	13%
GINGIN-2	6%
GINGIN-3	3%
GMaid01	5%
GMaid02	3%
GMaid03	3%
GMaid04	5%
gnan01	5%
gnan02	5%
gnan03	11%
GOLF-1	11%
gosn01	15%
gosn02	10%
gosn03	12%
gosn04	3%
gosn05	5%
gosn06	11%
gosn07	12%
gosn08	10%
gosn09	9%
gosn10	11%
gosn11	0%
gosn12	12%
gosn13	10%
Guild02	3%
Guild06	3%
Guild09	6%
GUTHR-1	10%
GUTHR-2	9%
GUTHR-3	11%
GUTHR-4	12%
GUTHR-5	7%
GUTHR-6	9%
Hamp01	13%
Hamp02	13%
Hamp03	10%
Hamp04	9%
HARRY-1	8%
HARRY-2	9%
HARRY-3	7%
HARRY-4	9%
HARRY-5	7%
HARRY-6	7%
hart01	10%
hart02	12%
hart03	23%
hart04	11%
Hay01	7%
Hay02	8%
Hay03	6%
Hay04	11%
Hay05	7%
Hepb01	10%
Hepb02	10%
Hepb03	5%
hurst01	15%
hurst02	4%
hurst03	13%
hurst04	10%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
hymus01	8%
hymus02	8%
hymus03	10%
hymus04	7%
hymus05	7%
hymus06	7%
iron01	0%
iron02	0%
jand01	11%
jand02	13%
jand03	9%
jand04	11%
jand05	3%
jand06	9%
jand07	9%
jand08	14%
kailis01	11%
kailis02	7%
kailis03	13%
kelly01	0%
kelly02	5%
KEME-1	8%
KEME-2	6%
KEME-3	5%
kemp01	6%
Kens01	12%
KERO-1	8%
KERO-2	9%
KING-1	13%
KING-2	13%
KOOLJ-1	13%
KOOLJ-2	10%
KOOLJ-3	10%
KOOLJ-4	10%
KOOLJ-5	11%
KOOLJ-6	10%
KOOLJ-7	11%
KOON-1	8%
KOON-2	11%
lamb1	4%
lamb2	12%
LAND-1	12%
leda01	11%
leda02	7%
leda03	4%
leda04	9%
LESCH-1	0%
LESCH-2	0%
LESCH-3	4%
LESCH-4	3%
LESCH-5	3%
LESCH-6	4%
Light01	16%
Light02	12%
Light03	17%
Light04	5%
low01	6%
low04	8%
low06a	6%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
low06b	8%
low07	11%
low08	12%
low09a	7%
low09b	11%
low10a	7%
low10b	3%
low12a	8%
low12b	8%
low13a	7%
low13b	4%
low14a	16%
LYONS-1	6%
LYONS-2	5%
m4601	4%
m4602	8%
M53	6%
m5302	13%
m5303	6%
m5304	5%
m5305	9%
m5306	11%
maida01	10%
maida02	7%
MANEA-1	10%
MANEA-2	13%
MANEA-3	7%
McLART-1	14%
MEAL-1	3%
MEAL-2	3%
MEELON-1	6%
MEELON-2	6%
MELA-1	12%
MELA-10	3%
MELA-2	8%
MELA-3	4%
MELA-5	9%
MELA-6	11%
MELA-7	5%
MELA-8	9%
MELA-9	7%
MGK01	11%
MGK02	6%
MGK03	7%
MGK04	7%
MHENRY-1	0%
MHENRY-2	16%
MHR01	9%
MHR02	5%
MHR03	3%
MI002MOR	17%
MI003MOR	12%
MI01	0%
MI02	3%
MI03	0%
MI04	0%
MI05	0%
MI06	3%
MI07	0%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
MI08	0%
MI09	0%
MI10	0%
MI11	4%
MI12	8%
MI13	5%
MI14	0%
MI15	5%
MI16	0%
MI17	9%
MI18	7%
MI19	6%
MI20	5%
MI21	5%
MI22	4%
MI23	3%
Mill01	13%
MILT-1	9%
MILT-2	5%
MILT-3	6%
MILT-4	9%
MILT-5	9%
MILT-6	6%
MILT-7	3%
MILT-8	0%
MIME 01	6%
MINN-1	3%
MINN-2	2%
MINN-3	5%
MNP01	11%
MNP02	3%
MNP03	6%
MODO-1	10%
MODO-2	19%
MODO-3	9%
MODO-4	9%
MODO-5	5%
MODO-6	11%
MOOR 01	7%
MOOR 02	4%
MOOR 03	3%
MOOR 04	15%
MOOR 05	11%
MOOR 06	3%
MOOR 07	3%
MOOR 08	7%
MOOR 09	5%
moore01	14%
moore02	16%
moore03	11%
MP01	9%
MP02	11%
MP03	14%
MP04	9%
MP05	6%
MP06	9%
MP07	10%
MP08	9%
MP09	5%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
MP10	18%
MP11	9%
MPK01	9%
MPK02	10%
MPK03	10%
MR01	0%
MR02	9%
MR03	9%
MR04	6%
MR05	9%
MR06	15%
MR07	8%
MR08	5%
MR09	8%
MR10	3%
MR11	10%
MR12	14%
MR13	3%
MR14	8%
MR15	17%
MR16	11%
MR17	12%
MR18	17%
mrnp01	9%
mrnp02	5%
mrnp03	17%
mrnp04	10%
MSF01	10%
MSF02	3%
MSF03	14%
MTB-1	7%
MTB-2	0%
MTB-3	12%
MTB-4	0%
MTB-5	6%
much01	14%
much02	24%
much03	10%
much04	3%
much05	5%
MUCK-1	11%
MUCK-2	5%
MUD-2	8%
MUD-3	9%
MUD-4	17%
MUD-5	12%
MUD-6	9%
MUD-7	7%
MUD-9	4%
MUK01	6%
MUK02	4%
MWR01	10%
MWR02	8%
MWR03	10%
MWR04	9%
MWR05	5%
MWR06	5%
MWR07	11%
MWR08	9%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
MWR09	3%
MWR10	9%
MYALUP-2	4%
NAVB-1	5%
NAVB-2	8%
NAVB-3	6%
NAVB-4	9%
NEER-1	3%
NEER-10	3%
NEER-11	8%
NEER-2	10%
NEER-20	9%
NEER-21	10%
NEER-22	10%
NEER-23	6%
NEER-3	14%
NEER-4	10%
NEER-5	12%
NEER-6	13%
NEER-7	7%
NEER-8	13%
NEER-9	12%
NINE-1	9%
NINE-2	10%
NMaid01	0%
NMaid03	6%
NMaid04	3%
NMaid05	5%
Norm03	10%
Norm04	7%
Norm06	8%
Norm07	0%
NPRES-1	0%
NWIL-1	0%
NWIL-2	8%
NWIL-3	6%
OYR01	8%
OYR02	4%
PAGA-1	7%
PAGA-2	9%
PAGA-3	10%
PAGA-4	10%
PAGA-5	5%
PAGA-6	0%
PAGA-7	4%
PAGA-8	10%
PAR1	0%
PAYNE-1	0%
PB-1	0%
PB-2	3%
PB-3	4%
PB-4	0%
PB-5	0%
PB-6	0%
PEARCE-1	12%
PEARCE-2	12%
PEPB-1	3%
PEPGRV-1	4%
PEPGRV-2	0%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
perth01	10%
perth02	16%
perth03	5%
perth04	15%
perth05	12%
perth06	16%
perth07	14%
perth08	12%
perth09	15%
perth10	25%
Pind01	13%
Pind02	13%
pinj01	0%
pinj02	4%
pinj03	4%
pinj04	5%
pinj05	7%
pinj06	12%
pinj07	14%
pinj08	5%
pinj09	17%
pinj10	9%
pinj11	5%
pinj12	13%
pinj13	10%
pinj14	12%
pinj15	4%
Pinn01	8%
Pinn02	0%
Pinn03	12%
pip01	8%
Plant01	3%
Plant02	6%
PLINE-1	3%
PLINE-2	8%
PLINE-3	7%
PLINE-4	4%
PLINE-5	4%
PLINE-6	5%
PLINE-7	3%
Possum1	0%
Possum2	8%
Possum3	5%
Possum4	0%
Possum5	4%
PRES-1	4%
PTWALT-1	13%
Punr01	9%
Punr02	14%
Punr03	11%
quinn01	2%
quinn02	12%
quinn03	10%
quinn05	11%
quinn06	7%
quinn07	5%
quinn08	6%
quinn09	4%
R116701	10%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
R116702	9%
R116703	11%
RAAF-1	5%
RAAF-2	5%
RAAF-3	8%
raven02	4%
raven03	16%
raven04	15%
raven05	9%
Ravs01	15%
Redh01	3%
Redh02	10%
Redh03	3%
Redh04	3%
Redh05	4%
Redh06	5%
Redh07	0%
Redh09	3%
Redh10	3%
REDL-1	8%
RGR01	6%
RGR02	21%
RGR03	6%
RGR04	3%
RGR05	5%
RGR06	8%
rich01	0%
rich02	3%
RIVD-1	10%
RIVD-2	8%
rott01	0%
rott02	4%
rott03	0%
rott04	0%
rott05	0%
rott06	0%
rowe01	5%
rowe02	8%
RUAB-1	10%
RUAB-2	5%
RUAB-3	9%
RUAB-4	5%
Rush01	11%
Rush02	9%
Rush03	4%
sams01	13%
sand01	9%
SANDON-1	0%
SEAB-1	0%
SEAB-2	5%
SEAB-3	3%
SEAB-4	5%
SEAB-5	5%
SEAB-6	6%
SEAB-7	2%
SEAB-8	0%
serp01	10%
serp02	13%
serp03	6%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
serp04	8%
SF01	11%
SF02	5%
SF03	13%
SF04	5%
SF1201	11%
SHE-1	5%
SHE-2	11%
SHE-3	5%
SHE-4	3%
SHE-5	3%
SHE-6	3%
SHENT-1	14%
SINT-1	9%
smith01	0%
smith02	4%
smith03	4%
smith04	0%
star01	11%
star02	10%
star03	7%
Sunday01	11%
Sunday02	11%
SVH-1	7%
SVH-2	0%
SW01	0%
SW02	0%
SW03	0%
SW04	4%
SW05	0%
SW06	3%
SW07	3%
SW08	4%
SW09	7%
SW10	0%
SW11	4%
Swamp01	4%
Swamp02	9%
Swamp03	15%
talb1	8%
talb10	7%
talb11	8%
talb12	8%
talb13	5%
talb2	7%
talb3	11%
talb4	11%
talb5	13%
talb6	10%
talb7	13%
talb8	8%
talb9	10%
TAM-1	11%
Tele01	16%
THOM-2	8%
tokyu01	6%
tokyu02	2%
tokyu03	10%
tokyu04	6%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
tokyu05	0%
tokyu06	3%
tokyu07	0%
TR01	0%
TR02	0%
TR03	0%
TR04	4%
TR05	0%
TR06	0%
TR07	0%
TR08	0%
TRIG-1	0%
TRIG-2	4%
TRIG-3	13%
TRIG-4	9%
TRIG-5	11%
TRIG-6	3%
trigg08	4%
TWIN-1	17%
TWIN-10	5%
TWIN-11	15%
TWIN-2	11%
TWIN-3	19%
TWIN-4	15%
TWIN-5	4%
TWIN-7	11%
TWIN-8	11%
vines01	3%
vines02	14%
WABL-1	3%
WABL-2	5%
WABL-3	8%
WABL-4	9%
WAND-1	9%
WARB-1	10%
WARB-2	9%
WARB-3	10%
WARB-4	8%
WARI-1	12%
WARI-2	11%
waro 01	2%
waro 02	11%
waro 03	3%
waro 04	0%
waro 05	5%
waro 06	8%
WATER-1	5%
WATER-2	11%
WATER-3	9%
WATER-4	9%
WATERRD1	10%
WELL-1	13%
WELL-2	10%
welr 01	11%
welr 02	7%
WHILL-1	3%
WHILL-2	0%
WHILL-3	0%
WHILL-4	0%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
WHILL-5	2%
white03	9%
white04	10%
white05	10%
white06	10%
white07	9%
white08	14%
WHITE-1	9%
WHITE-2	12%
wicher01	5%
wilb01	0%
wilb02	0%
wilb03	0%
wilb04	5%
wilb05	0%
wilb06	6%
wilb07	6%
wilb08	3%
wilb09	6%
wilb10	0%
wilb11	4%
wilb12	6%
wilb13	3%
will01	6%
will02	2%
will03	3%
will04	2%
wire01	13%
wire02	13%
WIRR-1	13%
WIRR-2	10%
WN019MNR	9%
WN020MNR	16%
WN021MNR	7%
WN084CHE	5%
WN085CHE	8%
WN086CHE	7%
WN087CHE	3%
WN088CHE	2%
WN089CHE	11%
WN090HED	9%
WN091HED	0%
WN092HED	3%
WN093HED	11%
WN094HED	7%
WN095HED	0%
WN096HED	5%
WN097HED	10%
WN098WNR	9%
WN099WNR	16%
WN100WNR	9%
WN101WNR	14%
WN102MNR	6%
WN103MNR	14%
WN104MNR	18%
WN105MNR	9%
WN106MNR	11%
WN107MNR	6%
WN108MNR	15%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
WN109MOR	23%
WN110MOR	13%
WN111MOR	13%
WN112MOR	17%
WN113MOR	10%
WN114MOR	11%
WN115MOR	6%
WN116MOR	10%
WN117MOR	9%
WONN-1	6%
WONN-3	4%
WONN-4	2%
WONN-5	6%
WONN-6	5%
WOODP-1	0%
WOODP-2	0%
WOODV-1	11%
WOODV-2	13%
xbeer01	3%
xbeer02	7%
xlamb01	13%
xpearce0	10%
xpearce0	18%
xpearce0	12%
xpearce0	4%
xpearce0	0%
xyan08	0%
xyan10	9%
YALG-1	2%
YALG-2	2%
YALG-3	0%
YALG-4	0%
YALG-5	3%
YALG-6	6%
YALG-7	0%
YALG-8	0%
YALLIN-1	6%
YAN-1	7%
YAN-10	5%
YAN-11	6%
YAN-12	2%
YAN-13	3%
YAN-14	0%
YAN-15	3%
YAN-16	3%
YAN-17	0%
YAN-18	4%
YAN-19	6%
YAN-2	5%
YAN-20	9%
YAN-21	9%
YAN-22	3%
YAN-23	0%
YAN-24	0%
YAN-25	5%
YAN-3	5%
YAN-4	12%
YAN-5	8%
YAN-6	8%

Appendix E Floristic Community Type Assessment Output

	Project Quadrat
SCP Quadrats	5
YAN-8	7%
YAN-9	11%
yang01	4%
yang02	9%
yang03	10%
yarl01	4%
yarl02	6%
yarl03	5%
yarl04	6%
yela01	13%
yela02	9%
yela03	3%
YIRON-1	0%
YIRON-2	4%
YOON-1	5%
YOON-2	5%
YOON-3	6%
YULE-1	14%
YULE-2	12%
YULE-3	12%
YULE-4	9%
YULE-5	7%
YUR01	9%
YUR02	9%
yuri01	8%
yuri02	12%
yuri03	14%
yuri04	11%
yuri05	20%
zBEER 01	10%
zBEER 02	5%
zBEER 03	10%
zBEER 04	11%
zYAN2	2%
zYAN4	0%
zYAN5	3%
zYAN6	10%