



Koorana Reserve Native Vegetation Clearing Permit Application

Prepared for
City of Rockingham

14 December 2018



DOCUMENT TRACKING

Item	Detail
Project Name	Koorana Reserve Native Vegetation Clearing Permit Application
Project Number	18PER-10901
Project Manager	Daniel Panickar +61 8 6218 2200 Level 1, Bishops See, 235 St Georges Terrace, Perth WA 6000
Prepared by	Jessica Hunter, Daniel Panickar
Reviewed by	Jen Longstaff
Approved by	Jen Longstaff
Status	FINAL
Version Number	V2
Last saved on	14 December 2018
Cover photo	Vegetation at Koorana Reserve.

This report should be cited as 'Eco Logical Australia 2018. *Koorana Reserve Native Vegetation Clearing Permit Application*. Prepared for the City of Rockingham'.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from the City of Rockingham.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and the City of Rockingham. The scope of services was defined in consultation with the City of Rockingham, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 29/9/2015

Contents

1	Introduction	5
1.1	Development overview and background	5
1.2	Purpose of this document.....	5
2	Physical Environment	7
2.1	Biogeographic and regional setting	7
2.2	Geology, landform and soils	7
2.3	Hydrology.....	7
2.3.1	Surface water.....	7
2.3.2	Groundwater	8
3	Biological Environment	9
3.1	Flora and Vegetation	9
3.1.1	Flora.....	9
3.2	Vegetation.....	10
3.2.1	Pre-European Vegetation Extent.....	10
3.2.2	Vegetation assessment	10
3.2.3	Vegetation condition	11
3.2.4	Threatened and Priority Ecological Communities	11
3.3	Terrestrial Fauna	11
3.3.1	Terrestrial fauna species	11
3.3.2	Terrestrial fauna habitat.....	12
3.3.1	Black cockatoo habitat.....	12
4	Assessment against the Ten Clearing Principles	17
4.1	Comprises high level of biological diversity	18
4.2	Potential impact to any significant habitat for fauna indigenous to Western Australia.....	18
4.3	Potential impact to any rare flora.....	18
4.4	Potential of any threatened ecological communities	19
4.5	Significance as a remnant of native vegetation in the area that has been extensively cleared .	19
4.6	Impact on any watercourses and/or wetlands	20
4.7	Potential to cause appreciable land degradation	20
4.8	Potential to impact on the environmental values of adjacent or nearby conservation areas	20
4.9	Potential deterioration in the quality of surface or underground water	20
4.10	Potential of clearing to cause, or exacerbate, the incidence of flooding	21
	References	22
	Appendix A : Koorana Reserve Flora and Fauna Survey	24

Appendix B : Likelihood of Occurrence Criteria	26
Appendix C : Flora likelihood of occurrence assessment	28
Appendix D : Fauna likelihood of occurrence assessment	35

List of figures

Figure 1: Site Overview	6
Figure 2: Vegetation associations of the reserve	13
Figure 3: Vegetation condition of the reserve	14
Figure 4: Fauna habitats within the reserve	15
Figure 5: Black cockatoo habitat within the reserve	16

List of tables

Table 3-1: Vegetation Association and Complex mapping units occurring within the reserve	10
Table 3-2: Vegetation associations within the reserve	11
Table 4-1: Summary of assessment against the ten clearing principles	17

1 Introduction

1.1 Development overview and background

The City of Rockingham is proposing to clear vegetation to develop playing fields at Koorana Reserve, located at 46 Royal Palm Drive, Warnbro ('the reserve'; **Figure 1**). Proposed works include the clearing of vegetation and topsoil, followed by earthworks and development of the playing fields and associated facilities. The removal of 0.93 hectares (ha) of native vegetation will be undertaken within a 1.73 ha proposed clearing area. 1.19 ha of vegetation north, east and south of the proposed clearing area will be retained as part of the development.

The reserve (Lot 4240 on P 21088) is zoned as 'Public Open Space' under the City of Rockingham Town Planning Scheme No. 2 and 'Parks and Recreation' under the Metropolitan Region Scheme.

Over half of the reserve is currently occupied by playing fields, while the remainder is comprised of scattered remnant vegetation in a generally degraded condition. ELA undertook a Detailed and Targeted Flora and Vegetation Survey and Level 1 Fauna Survey including a black cockatoo habitat assessment on 28 September 2018 to determine the composition and value of the vegetation and fauna assemblages currently present within the reserve (ELA 2018, **Appendix A**).

1.2 Purpose of this document

As the proposed development requires the clearing of native vegetation, an assessment of the proposed vegetation clearing against the ten native vegetation clearing principles contained in Schedule 5 of the *Environmental Protection Act 1986* (EP Act) is required. This Native Vegetation Clearing Permit (NVCP) application has been prepared for the Department of Water and Environmental Regulation (DWER) to address this requirement.

Figure 1: Site Overview



Figure 1: Site Overview

2 Physical Environment

2.1 Biogeographic and regional setting

The reserve is located in the Swan Coastal Plain bioregion as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) (DotEE 2018a). The Swan Coastal Plain bioregion has been further subdivided into two sub-regions: Dandaragan Plateau (SWA1); and Swan Coastal Plain (SWA2). The reserve is located in the Swan Coastal Plain sub-region, which is described by Mitchell et al. (2002) as:

A low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils. Casuarina obesa on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. The climate is Warm Mediterranean. It is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone.

2.2 Geology, landform and soils

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone with dominant vegetation comprised of heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvial sands. The subregion also includes a complex series of seasonal wetlands (Mitchell et al. 2002).

The topography of the reserve was noted to be variable, with differences in elevation due to the construction of man-made playing areas etc. The highest elevations were at the eastern site boundary with lowest elevation in the western portion where a small stormwater depression is situated. The Perth Groundwater Atlas indicates the topography of the reserve slopes in a westerly direction on the western side and easterly on the eastern side, with elevation contours depicting the site at between 4 and 11 m Australian Height Datum (mAHD) (DWER 2018).

The soils and geology of the area are typical for areas on coastal plains. Based on the Geological Survey of Western Australia Geological Series Perth (GSWA 1978), the geological profile beneath the reserve is generally characterised by the quaternary Safety Bay Sands, comprising of eolian and beach lime sand which has been slightly lithified. Directly to the east of site at Lake Walyungup, the geology changes to estuarine, lagoonal and lacustrine deposits, comprising of clay, silt, marl with shell beds. To the east of estuarine sands lies Tamala Limestone.

2.3 Hydrology

2.3.1 Surface water

The reserve lies in the Cockburn/Kwinana Coastal catchment area. No wetlands have been identified within the site (DBCA 2018a). Lake Walyungup is located approximately 600 m to the east of the reserve, used as a recreational area, particularly land sailing (DBCA 2018a). The area on the eastern side of Ennis Ave is built up between the reserve and Lake Walyungup and therefore surface water is not expected to runoff towards the lake.

A small stormwater depression is located in the north-western corner of the reserve, with two drains present at this location. These are expected to capture runoff from the playing surface. Another depression exists on the eastern side of the reserve in the bushland, where water sits during winter and infiltrates the ground surface.

2.3.2 Groundwater

Groundwater mapping shows the average maximum groundwater level for the reserve is at approximately 4 mAHD to 11 mAHD (DWER 2018).

The reserve is located above a shallow aquifer with regional flow unknown but likely to be westerly towards the coastline (Coffey 2018).

Based on the topographic and groundwater contours, the inferred depth for the site is 3 meters below ground level (mbgl) in the depression in the north-west corner of the reserve to 8.5 mbgl in the eastern portion of the reserve.

3 Biological Environment

3.1 Flora and Vegetation

Vegetation within the reserve has been subject to clearing, degradation and revegetation works over a number of years, however still contains native species, albeit in a degraded condition. ELA undertook a Detailed and Targeted Flora and Vegetation Survey and Level 1 Fauna Survey including a black cockatoo habitat assessment on 28 September 2018 to determine the composition and value of the vegetation and fauna assemblages currently present within the reserve (ELA 2018).

3.1.1 Flora

Database searches using *NatureMap* (DBCA 2007-2018), and the Department of the Energy and Environment (DotEE) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) *Protected Matters Search Tool* (PMST) (DotEE 2018b) were undertaken to determine the presence of Threatened or Priority flora species known from the area surrounding the reserve. A 10 km buffer around the reserve was used for each of the above database searches. This buffer is considered suitable based on flora and fauna assemblages expected to occur within the reserve.

Desktop and database searches and site assessment identified 174 taxa of terrestrial vascular flora representing 60 families potentially occurring within the reserve, including 44 introduced species. The most common families were Fabaceae (15 native species, two introduced), Cyperaceae (13 native species) and Poaceae (three native species, ten introduced).

The flora and vegetation survey undertaken by ELA recorded 46 taxa from 37 genera and 23 families which confirmed that the reserve was an extremely degraded representation of local vegetation and did not contain the diversity suggested by the desktop assessment (ELA 2018).

Threatened and Priority Flora

A likelihood of occurrence assessment for Threatened and Priority flora species was undertaken (likelihood criteria – **Appendix B**). A total of six conservation listed flora species were initially considered to have the potential to occur within the reserve (**Appendix C**), however ELA (2018) did not record any of these.

It is considered that no Threatened flora species listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by DBCA (2018b) or Priority flora species as listed by Western Australian Herbarium (1998-) were present at the reserve. The primarily degraded habitat within the reserve is unlikely to support any of the conservation significant species identified in the desktop searches.

Introduced species

A total of 14 weed species were recorded within the reserve, six of which are from the Poaceae family. One of the recorded weed species (*Gomphocarpus fruticosus*) is listed as a Declared Plant species in Western Australia pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act; DPRID 2018).

3.2 Vegetation

3.2.1 Pre-European Vegetation Extent

Vegetation type and extent in WA has been mapped at a regional scale by Beard (1981), who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:1,000,000, DAFWA has compiled a list of vegetation extent and types across WA (Shepherd et al. 2002). The reserve intersects one vegetation system association:

Rockingham 3048 (Shrublands; scrub-heath on the Swan Coastal Plain).

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle et al. (1980). Vegetation within the reserve is associated with the Quindalup Complex as mapped by Heddle et al (1980) and described as;

Coastal dune complex consisting mainly of two alliances - the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of Melaleuca lanceolata - Callitris preisei and the closed scrub of Acacia rostellifera.

The pre-European and current extent of native vegetation associations in WA has been interpreted by Shepherd et al. (2002) using data from Beard's (1981) regional vegetation mapping, along with other vegetation mapping and satellite imagery and orthophoto interpretation. A summary of the pre-European and current extent of native vegetation associations within the reserve is provided in Error! Reference source not found..

Table 3-1: Vegetation Association and Complex mapping units occurring within the reserve

Vegetation Association (Beard 1980)	Pre-European extent (ha) (Government of WA 2018a)	Current extent (ha) (% remaining) (Government of WA 2018a)	Extent proposed for clearing (ha) (% of current extent)
Rockingham System – 3048	10,418.06	3,035.78 (29.14%)	0.93 (0.03%)
Vegetation Complex (Heddle et al. 1980)	Pre-European extent (ha) (Government of WA 2018b)	Current extent (ha) (% remaining) (Government of WA 2018b)	Extent within the site (ha) (% of current extent)
Quindalup	54,573.87	32,982.87 (60.44%)	0.93 (0.003%)

3.2.2 Vegetation assessment

ELA (2018) identified and described three vegetation associations within the reserve. Vegetation associations are described in full, including associated species, in **Table 3-2** and are presented in **Figure 2**. Only one of these associations is resemblant of its' native structure and composition and is well represented in the broader area. The other two associations represent revegetation (with remnant trees) and cleared areas.

Table 3-2: Vegetation associations within the reserve

Vegetation associations	Extent proposed for clearing (ha)
ArJf: <i>Acacia rostellifera</i> and <i>Jacksonia furcellata</i> open shrubland over <i>Bromus diandrus</i> open grassland over <i>Euphorbia terracina</i> <i>Pelargonium capitatum</i> and <i>Senecio pinnatifolius</i> sparse forbland over <i>Lepidosperma pubisquameum</i> sparse sedgeland.	0.39
Revegetation: <i>Eucalyptus gomphocephala</i> (Tuart), <i>Eucalyptus camaldulensis</i> and <i>Agonis flexuosa</i> var. <i>flexuosa</i> over grass weeds. Other planted species include <i>Casuarina glauca</i> . Remnant trees also present.	0.54
Cleared: Previously cleared area used for playing fields, tracks etc.	0.79
Total	1.73

3.2.3 Vegetation condition

Vegetation condition within the reserve ranged from Completely Degraded to Good based on the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a; **Figure 3**). Significant disturbance was noted throughout the reserve and cleared tracks and fields, revegetated areas and weed infested vegetation dominated.

3.2.4 Threatened and Priority Ecological Communities

None of the vegetation associations identified within the reserve resemble any known Threatened Ecological Communities (TECs) listed under the EPBC Act or WC Act, or Priority Ecological Communities (PECs) listed by DBCA.

3.3 Terrestrial Fauna

3.3.1 Terrestrial fauna species

A total of 174 taxa were identified to potentially occur within the vicinity of the reserve, 65 of which were considered to be conservation significant. All marine mammals, Whales and other Cetaceans, fish and marine reptiles have not been included in this assessment as the reserve is not situated in a marine area.

A total of ten fauna species were recorded within the reserve including eight birds, one mammal and one reptile, confirming that the reserve was an extremely degraded representation of local vegetation and did not contain the diversity suggested by the desktop assessment (ELA 2018).

One introduced fauna species, *Feils catus* (Cat) was recorded within the reserve.

Threatened and Priority fauna

No Commonwealth or State listed Threatened or Priority fauna species were recorded within the reserve.

A likelihood of occurrence assessment for Threatened and Priority fauna species was undertaken (likelihood criteria – **Appendix B**). Of the 69 conservation listed fauna species identified in the desktop assessment as possibly occurring within the reserve, 11 species were found to have the potential to occur. This assessment is based on availability of suitable habitat, proximity of previous records and adequate survey effort (**Appendix D**).

The high mobility level of all species identified, combined with degraded habitat lead to the inference that none of the species is likely to occur in high numbers and most likely occur as vagrants. Migratory birds

that frequent the ocean and beach may occasionally fly over the reserve but would not utilise the habitats in this area on a regular basis.

3.3.2 Terrestrial fauna habitat

ELA (2018) identified two broad fauna habitats within the reserve (**Figure 4**):

- Fauna habitat type 1: *Acacia rostellifera* and *Jacksonia furcellata* open shrubland; and
- Fauna habitat type 2: Revegetation area comprised of tall *Eucalyptus gomphocephala* (Tuart), *Eucalyptus camaldulensis* and *Agonis flexuosa* var. *flexuosa* over grass weeds.

Both these fauna habitats are considered as common on the Swan Coastal Plain.

3.3.1 Black cockatoo habitat

ELA (2018) determined that vegetation within the reserve provides foraging habitat for Carnaby's Black-Cockatoo, however no evidence of foraging was recorded. This habitat quality is predominantly very poor within native vegetation, however ranges to good within revegetated areas due to the presence of large eucalypts and other foraging species. Approximately 0.54 ha of good quality habitat and 0.39 ha of very poor quality habitat occurs within the proposed clearing area. Twelve potentially significant remnant trees were identified within the reserve, however none of these trees contained a hollow of sufficient size to be utilised by black cockatoos for breeding purposes. All of these trees will be retained post-clearing (Figure 5).

Figure 2: Vegetation Association



Figure 2: Vegetation associations of the reserve

Figure 3: Vegetation Condition

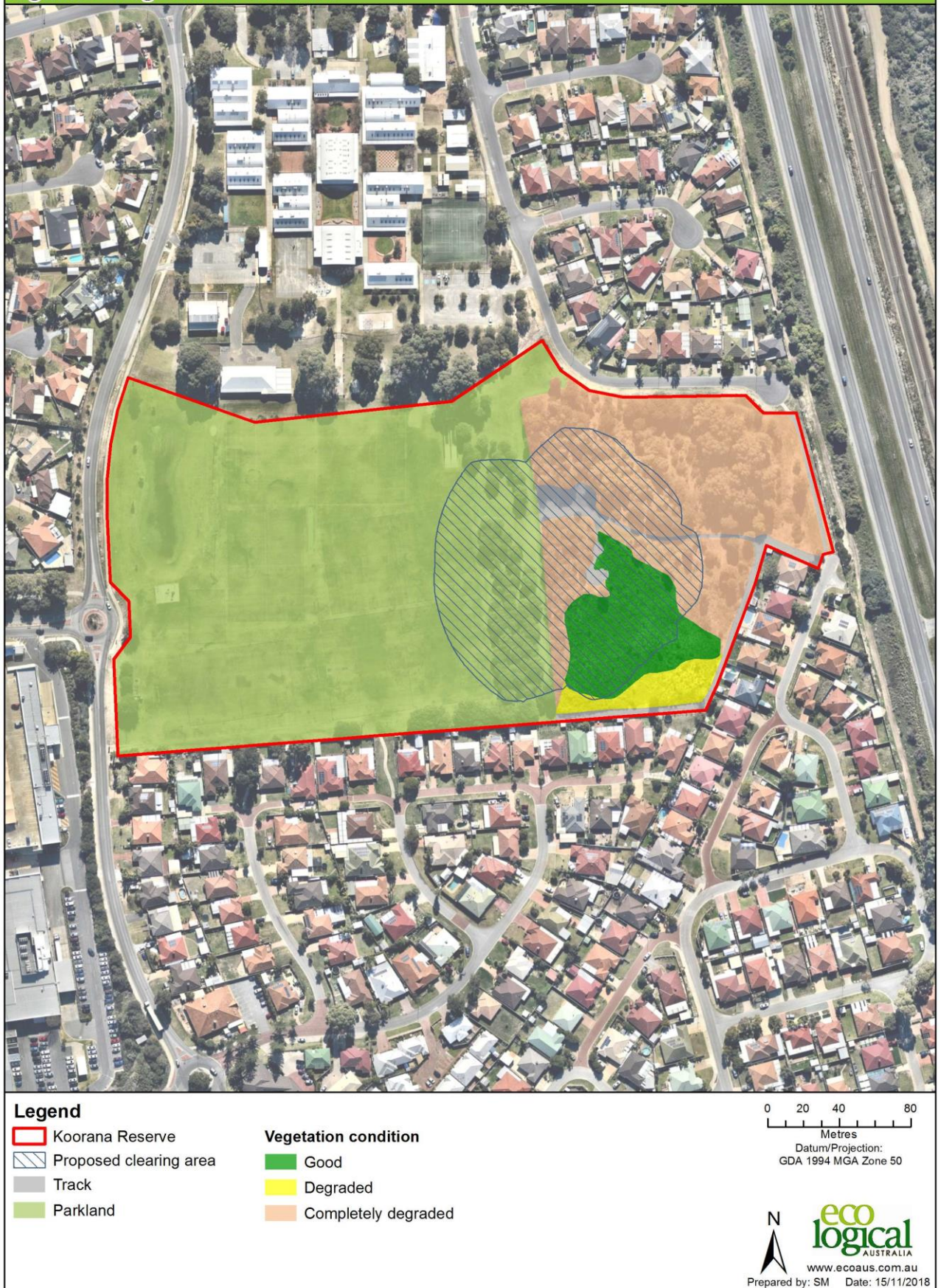


Figure 3: Vegetation condition of the reserve

Figure 4: Fauna Habitat**Figure 4: Fauna habitats within the reserve**

Figure 5: Black Cockatoo Habitat**Figure 5: Black cockatoo habitat within the reserve**

4 Assessment against the Ten Clearing Principles

An assessment of the proposed vegetation clearing against the ten native vegetation Clearing Principles contained in Schedule 5 of the EP Act is provided in Sections 3.1 to 3.10. **Table 4-1** contains a summary of the assessment.

The proposed clearing may be at variance with one of the Principles.

Table 4-1: Summary of assessment against the ten clearing principles

Clearing Principle	Is not at variance	May be at variance
a) Native vegetation should not be cleared if it comprises a high level of biological diversity	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b) Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of Rare flora	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d) Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of a threatened ecological community (TEC)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e) Native vegetation should not be cleared if it is significant as remnant vegetation in an area that has been extensively cleared	<input checked="" type="checkbox"/>	<input type="checkbox"/>
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	<input checked="" type="checkbox"/>	<input type="checkbox"/>
g) Native vegetation should not be cleared if the clearing of vegetation is likely to cause appreciable land degradation	<input checked="" type="checkbox"/>	<input type="checkbox"/>
h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	<input checked="" type="checkbox"/>	<input type="checkbox"/>
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	<input checked="" type="checkbox"/>	<input type="checkbox"/>
j) Native vegetation should not be cleared if the clearing of vegetation is likely to cause, or exacerbate, the incidence of flooding	<input checked="" type="checkbox"/>	<input type="checkbox"/>

4.1 Comprises high level of biological diversity

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

ELA (2018) identified 46 taxa from 37 genera and 23 families within three vegetation associations in the reserve. Only one of these associations is ressemblant of its' native structure and composition and is well represented in the broader area. The other two associations represent revegetation (with remnant trees) and cleared areas.

Vegetation condition within the reserve ranged from Completely Degraded to Good. Significant disturbance was noted throughout the reserve and cleared tracks and fields, revegetated areas and weed infested vegetation dominated.

The reserve is not considered to contain an unusually high level of biological diversity and the proposed clearing is not considered to be at variance with this Principle.

4.2 Potential impact to any significant habitat for fauna indigenous to Western Australia

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

A total of ten fauna species from two fauna habitats were recorded within the reserve including eight birds, one mammal and one reptile, confirming that the reserve did not contain the diversity suggested by the desktop assessment (ELA 2018).

No Commonwealth or State listed Threatened or Priority fauna species were recorded within the reserve. Eleven conservation listed fauna species were considered potential to occur. Although these species are considered to have the potential to occur, the reserve is not considered to comprise core habitat which these species would be solely reliant on.

Vegetation within the reserve provides foraging habitat for Carnaby's Black-Cockatoo, however ELA (2018) did not record any black cockatoos or evidence of foraging. This habitat quality is predominantly very poor within native vegetation, however ranges to good within revegetated areas due to the presence of large eucalypts and other foraging species. Approximately 0.54 ha of good quality habitat and 0.39 ha of very poor quality habitat occurs within the proposed clearing area. Twelve potentially significant remnant trees were identified within the reserve, however none of these trees contained a hollow of sufficient size to be utilised by black cockatoos for breeding purposes.

1.19 ha of vegetation in the reserve will be retained as part of the development. This area corresponds with the good quality black cockatoo foraging habitat and the location of all 12 potentially significant trees and will ensure that the best quality black cockatoo habitat in the reserve is retained.

Based on the assessment above, vegetation proposed to be cleared is not considered to contain significant habitat for any fauna species and the proposed clearing is not anticipated to be at variance to this Principle.

4.3 Potential impact to any rare flora

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

No Threatened flora species listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by DBCA (2018b) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the reserve (ELA 2018).

The proposed clearing is not considered to be at variance with this Principle.

4.4 Potential of any threatened ecological communities

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

None of the vegetation associations identified within the reserve resemble any known Threatened Ecological Communities (TECs) listed under the EPBC Act or WC Act, or Priority Ecological Communities (PECs) listed by DBCA (ELA 2018).

The proposed clearing is not at variance with this Principle.

4.5 Significance as a remnant of native vegetation in the area that has been extensively cleared

Principle (e): Native vegetation should not be cleared if it is significant as remnant vegetation in an area that has been extensively cleared.

The reserve occurs within one vegetation association defined by Shepherd et al. (2002), Rockingham 3048 and one vegetation complex defined by Heddle et al (1980), Quindalup Complex. A total of 3,035.78 ha (29.14%) of 'Rockingham Vegetation Association 3048' and 54,573.87 ha (60.44%) of these vegetation associations and complexes remain on the Swan Coastal Plain respectively (Government of Western Australia 2018a, 2018b).

The State Government is committed to the National Objectives and Targets for Biodiversity Conservation (Commonwealth of Australia 2001) that includes a target of avoiding additional clearance of ecological communities with an extent below 30% of that present prior to European settlement. Whilst the Rockingham 3048 vegetation association has less than 30% of its pre-European extent remaining, the proposed clearing will only reduce the extent of this vegetation association by 0.03% (i.e. 0.93 ha).

1.19 ha of vegetation in the reserve will be retained as part of the development. This will ensure that some of the vegetation in the local area is retained.

The proposed clearing is not considered to be at variance with this Principle.

4.6 Impact on any watercourses and/or wetlands

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

There are no watercourses or wetlands located in the reserve. The closest wetlands are Outridge Swamp, approximately 1.5 km to the south-east and Becher Lakes Boulevard, approximately 1.5 km to the south-west. The closest permanent major watercourse is Lake Walungup, located approximately 600 m to the east.

Given the area to the east of the reserve is built up (Ennis Avenue), the separation distance of the reserve to the nearest wetland, and the nature of the development (i.e. simple clearing to construct playing fields and associated infrastructure); the proposed clearing is not anticipated to have an impact to any watercourses or wetlands and is not considered to be at variance to this Principle.

4.7 Potential to cause appreciable land degradation

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

The reserve will be cleared for construction of playing fields and associated infrastructure. The potential impacts of clearing and construction, such as land degradation from erosion and sedimentation, will be managed by undertaking the standard avoidance and mitigation measures applicable to construction activities, such as the installation of wind fencing around the perimeter of the site to minimise impacts on adjacent vegetation.

The proposed clearing is not anticipated to cause appreciable land degradation and is not considered to be at variance to this Principle.

4.8 Potential to impact on the environmental values of adjacent or nearby conservation areas

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

There are no conservation areas adjacent to the reserve. An unnamed nature reserve and the Port Kennedy Scientific Park lies approximately 4 km to the south-west.

The proposed clearing is not anticipated to cause degradation to environmental values adjacent to the site and is not considered to be at variance to this Principle.

4.9 Potential deterioration in the quality of surface or underground water

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

There are no watercourses or wetlands located within the reserve. The closest water features are Lake Walungup located approximately 600 m to the east of the reserve, and the Indian Ocean situated approximately 2 kilometres to the west. There is a small stormwater depression containing two drains present in the north-western corner of the reserve that is expected to catch run-off from the playing surface, and a depression to the east, where water sits during winter and infiltrates the ground surface.

Given the significant distance to the closest surface water body and inferred depth to groundwater of 3 m to 8.5 m below ground level; the proposed clearing is not considered likely to cause deterioration to the quality of surface or underground water.

The proposed clearing is not at variance with this Principle.

4.10 Potential of clearing to cause, or exacerbate, the incidence of flooding

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

The reserve is relatively flat and is not located on a flood plain, reducing the chance of water pooling. There are no watercourses or wetlands located within the reserve. The soils of the site are porous Safety Bay Sands; hence it is likely that the surface water would rapidly infiltrate the soil rather than form sheet flow (with the exception of large rainfall events, which are likely to result in some surface run off). The development may include hard surfaces but will not significantly alter drainage flows or overland sheet flow.

The proposed clearing is not anticipated to cause or exacerbate flooding and is not considered to be at variance to this Principle.

References

- Armstrong, K., Woinarski, J. & Burbidge, A.A. 2017. *Falsistrellus mackenziei*. The IUCN Red List of Threatened Species 2017: e.T17348A22128228. <http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T17348A22128228.en>.
- Beard, J.S. 1981. *Vegetation Survey of Western Australian: Swan 1:1,000,000 Series. Explanatory Notes to Sheet 7*. University of Western Australia, Perth.
- BirdLife International. 2016c. *Falco peregrinus*. The IUCN Red List of Threatened Species 2016: e.T45354964A95143387. <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T45354964A95143387.en>.
- Commonwealth of Australia. 2001. *National Objectives and Targets for Biodiversity Conservation 2001–2005*. Canberra.
- Department of Agriculture and Food Western Australia (DAFWA). 2007. *Soil – Landscape Mapping of the South West of Western Australia*. Department of Agriculture and Food Western Australia, Perth.
- Department of Agriculture and Food Western Australia (DAFWA). 2016. *Western Australian Organism List (WAOL)*. Available from: <https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>.
- Department of Biodiversity, Conservation and Attractions (DBCA). 2007 - 2018. *NatureMap*. Department of Parks and Wildlife and WA Museum. Available from: <http://naturemap.dpaw.wa.gov.au/default.aspx>. Accessed August 2018.
- Department of Biodiversity, Conservation and Attractions (DBCA). 2018a. *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)* [Online], Available from <https://nationalmap.gov.au/>. Accessed May 2018.
- Department of Biodiversity Conservation and Attractions (DBCA). 2018b. *Wildlife Conservation (Threatened Flora) Notice 2017*. Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/fauna_notice.pdf. Accessed September 2018.
- Department of the Environment and Energy (DotEE). 2018a. Australia's *bioregions (IBRA)*. Available from: <https://www.environment.gov.au/land/nrs/science/ibra>.
- Department of the Environment and Energy (DotEE). 2018b. EPBC *Protected Matters Search Tool*. Available from: <http://www.environment.gov.au/epbc/pmst/>.
- Department of the Environment and Energy (DotEE). 2018c. *Species Profile and Threats Database (SPRAT)*. Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.
- Department of Primary Industries and Regional Development (DPRID). 2018. *Western Australian Organism List: Declared Pests*. Available from: https://www.agric.wa.gov.au/organisms?search_string=%2A&ref_code_name=PER-DP. Accessed September 2018,
- Department of Water and Environmental Regulation (DWER) 2018, *Perth Groundwater Map* [Online], Available from <https://maps.water.wa.gov.au/#/webmap/gwm>
- Eco Logical Australia 2018. *Koorana Reserve Flora and Fauna Survey*. Prepared for the City of Rockingham.

Geological Survey of Western Australia. (GSWA). 1978. *Geological Series, Perth WA 1:250,000 Environmental Geology Series*. Geological Survey of Western Australia.

Government of Western Australia. 2018a. *2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report)*. Current as of December 2017. WA Department of Biodiversity, Conservation and Attractions, Perth.

Government of Western Australia. 2018b. *2017 South West Vegetation Complex Statistics*. Current as of October 2017. WA Department of Biodiversity, Conservation and Attractions, Perth.

Hedde, E. M., Loneragan, O. W., and Havel, J. J (1980) *Atlas of Natural Resources Darling System, Western Australia*. Department of Conservation and Environment.

Marchant, S. & Higgins, P.J. 1990. *Handbook of Australian, New Zealand & Antarctic birds*. Oxford University Press, Melbourne.

Mitchell, D., Williams, K. and Desmond, A. 2002. *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* in: A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002.

Shepherd, D.P., Beeston, G.R., and Hopkins, A.J.M. 2002. *Native Vegetation in Western Australia – Extent, Type and Status*. Resource Management Technical Report 249, Department of Agriculture, Western Australia.

Western Australia Department of Environment and Conservation (WA DEC) 2007. *Records held in DEC's Declared Flora Database and rare flora files*. Perth, Western Australia: Department of Environment and Conservation.

Appendix A : Koorana Reserve Flora and Fauna Survey

Matthew Emmott

City of Rockingham

PO Box 2142 ROCKINGHAM DC WA 6967

ELA reference: 10901

25 October 2018

Dear Matthew,

Koorana Reserve Flora and Fauna Survey

Introduction

Eco Logical Australia (ELA) was engaged by the City of Rockingham to undertake a Detailed and Targeted flora survey and a Level 1 fauna survey including a black cockatoo habitat assessment to support environmental approvals facilitating the development of Koorana Reserve (the reserve). The reserve is located at 46 Royal Palm Drive, Warnbro and encompasses approximately 6.85 ha (hectares), over half of which is currently occupied by playing fields (**Figure 1**). Scattered remnant vegetation is present in the remaining portions of the reserve; in a generally degraded condition.

The objectives of the survey were to delineate and characterise the flora, fauna and range of vegetation associations and fauna habitats present within the study area and to assess for the presence of any conservation significant flora or fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Wildlife Conservation Act 1950* (WC Act) or by the Department of Biodiversity, Conservation and Attractions (DBCA), including the presence of any suitable habitat for these species. A targeted habitat assessment for black cockatoos listed as Threatened under the EPBC Act (Carnaby's Black-Cockatoo [*Calyptorhynchus latirostris*], Baudin's Black-Cockatoo [*Calyptorhynchus baudinii*] and Forest Red-tailed Black-Cockatoo [*Calyptorhynchus banksii naso*]) was also undertaken.

Methodology

Desktop review and likelihood of occurrence

Prior to the survey, ELA conducted a desktop assessment to gather information on potentially occurring conservation listed flora, vegetation and fauna within the study area. The following databases were searched:

- Commonwealth EPBC Act Protected Matters Search Tool (PMST) for Threatened species and communities listed under the EPBC Act (DotEE 2018a); and
- DBCA and WA Museum's NatureMap (DBCA 2007 – 2018).

A 10 km buffer around the reserve was used for each of the above database searches. This buffer is considered suitable based on flora and fauna assemblages expected to occur within the reserve. An initial six conservation listed flora taxa and 69 fauna taxa were identified as possibly occurring within the reserve based on database searches. Marine, migratory marine and migratory wetland species were not considered in the likelihood of occurrence assessment as the reserve does not contain core habitat that these species solely rely on for survival.

Survey team and timing

The survey was conducted on 28 September 2018 by Joel Collins (Senior Ecologist). The flora survey was conducted in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a). The fauna survey was conducted in accordance with the EPA *Technical Guidance: Terrestrial Fauna Surveys* (EPA 2016b). The black cockatoo habitat assessment was undertaken in accordance with the Department of the Environment and Energy's (DotEE) *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species* (DSEWPac 2012).

Based on climate data from the nearby Bureau of Meteorology (BoM) Hopelands Weather Station (Station number 9253, rainfall data 2000 – current, approximately 10.8 km east of the reserve), the reserve received a total of 435 millimetres (mm) of rainfall between May and July 2018 (no data available for August), which is above the annual average rainfall of 353.8 mm for the same period (BoM 2018). The weather conditions were considered suitable for survey as the amount and timing of rainfall resulted in sufficient material present (flowering herbs) at the time of the survey.

Flora and fauna survey

The desktop review, including review of aerial imagery and database searches, informed the approximate number of sites required to describe vegetation communities within the reserve. Three quadrats and two relevés were established across the reserve to delineate and characterise vegetation communities and fauna habitat. Location of quadrats and relevés are shown in **Figure 1**.

The following tasks were undertaken within the reserve as part of the flora and vegetation survey:

- Vegetation assessment (including quadrats and relevés) to delineate and characterise vegetation associations, including a vegetation condition assessment;
- Targeted survey for conservation significant flora and habitat supporting these species; and
- Record of opportunistic introduced flora.

The following tasks were undertaken within the reserve as part of the Level 1 fauna survey:

- Delineate and characterise fauna habitat present;
- Transects and opportunistic observations to develop a list of fauna species present; and
- Survey for conservation significant fauna and habitat supporting these species.

Desktop assessments identified the potential occurrence of all three species of Threatened black cockatoos occurring in Western Australia (Forest Red-tailed Black-Cockatoos [FRTBC], Baudin's Black-Cockatoos [BBC] and Carnaby's Black-Cockatoos [CBC]) within the reserve.

A targeted black cockatoo habitat assessment was undertaken which incorporated the following:

- a foraging assessment to identify potential black cockatoo foraging species; and
- a significant tree assessment to identify any trees with the potential to be utilised by black cockatoos for breeding.

The Reserve was traversed on foot to record any flora species with the potential to provide a food source for black cockatoos. Following the assessment, vegetation units were defined and mapped based on dominant flora species contained within. These units were then assigned a foraging value based on the presence and quantity of potential food species and any evidence of foraging by black cockatoos.

Significant trees are defined as trees of suitable species with a diameter at breast height (DBH) greater than 500 mm (> 300 mm for salmon gum and wandoo) (DSEWPaC 2012). Trees with a DBH greater than 500 mm (or >300 mm for salmon gum and wandoo) are large enough to potentially contain hollows suitable for nesting black cockatoos, or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). The locations of such trees within the Reserve were recorded using a Global Positioning System (GPS) device. In addition to the location and DBH, the species of each tree was also recorded.

Environmental setting

Climate

The Reserve is situated within the Swan Coastal Plain 2 (Perth) sub-region of the Swan Coastal Plain bioregion under the Interim Biogeographic Regionalisation for Australia (IBRA). This subregion experiences a warm, Mediterranean climate with hot dry summers and mild wet winters (Mitchell et al. 2002).

Landform, topography and soils

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone with dominant vegetation comprised of heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvial sands. The subregion also includes a complex series of seasonal wetlands (Mitchell et al. 2002).

The topography of the Reserve was noted to be variable, with differences in elevation due to the construction of man-made playing areas etc. The highest elevations were at the eastern site boundary with lowest elevation in the western portion where a small stormwater depression is situated. The Perth Groundwater Atlas indicates the topography of the site slopes in a westerly direction on the western side of site and easterly on the eastern side of site, with elevation contours depicting the site at between 4 and 11m Australian Height Datum (mAHD) (DWER 2018).

The soils and geology of the area are typical for areas on coastal plains. Based on the Geological Survey of Western Australia Geological Series Perth (GSWA 1978), the geological profile beneath the site is generally characterised by the quaternary Safety Bay Sands, comprising of eolian and beach lime sand which has been slightly lithified. Directly to the east of site at Lake Walyungup, the geology changes to estuarine, lagoonal and lacustrine deposits, comprising of clay, silt, marl with shell beds. To the east of estuarine sands lies Tamala Limestone.

Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia [IBRA]) for Western Australia (DotEE 2018b).

Beard (1990) Botanical Subdistrict

The Reserve within the Drummond Botanical Subdistrict which is characterised by low Banksia woodlands on leached sands; Melaleuca swamps on poorly-drained depressions; and Eucalyptus gomphocephala (Tuart), Eucalyptus marginata (Jarrah) and Corymbia calophylla (Marri) woodlands on less leached soils (Beard 1990).

IBRA subregion

IBRA divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate, lithology, geology, landform and vegetation (McKenzie et al. 2003). The site is located within the Swan Coastal Plain bioregion, which is dominated by woodlands of Banksia and Tuart on sandy soils, Sheoaks on outwash plains and Paperbarks in swampy areas (McKenzie et al. 2003).

System 6 mapping

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle et al. (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The Reserve occurs within the Quindlaup vegetation complex which is described as:

Coastal dune complex consisting mainly of two alliances - the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* - *Callitris preisei* and the closed scrub of *Acacia rostellifera*.

At a finer scale, the Reserve falls within the Rockingham 3048 vegetation system association (Shrublands; scrub-heath on the Swan Coastal Plain) as defined in Government of Western Australia (2018).

Figure 1: Site Overview



Legend

- Koorana Reserve
- Quadrats

0 75 150 300

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

eco
logical
AUSTRALIA

www.ecoaus.com.au

Prepared by: SM Date: 25/10/2018

Results

Flora and vegetation

A total of 46 taxa from 37 genera and 23 families were recorded from within the Reserve. A complete flora species list is provided in **Appendix A**. Families with the highest number of species included Fabaceae (8 species) and Poaceae (7 species). Site data is presented in **Appendix B**.

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by DBCA (2018) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the Reserve. Six conservation significant flora species were initially considered to have the potential to occur within the Reserve (**Appendix C**), however the primarily degraded habitat within the Reserve is unlikely to support any of these species.

Three vegetation associations were identified within the Reserve. Vegetation associations are described in full, including associated species, in **Table 1** and are presented in **Figure 2**. Only one of these associations is resemblant of its' native structure and composition and is well represented in the broader area. The other two associations represent revegetation (with remnant trees) and cleared areas. None of the associations resemble any known Threatened Ecological Communities (TECs) listed under the EPBC Act or Priority Ecological Communities (PECs) listed by DBCA.

Vegetation condition within the Reserve ranged from Completely Degraded to Good based on the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a; **Figure 3**). Significant disturbance was noted throughout the Reserve and cleared tracks and fields, revegetated areas and weed infested vegetation dominated.

A total of 14 weed species were recorded within the Reserve, six of which are from the Poaceae family. One of the recorded weed species (**Gomphocarpus fruticosus*) is listed as a Declared Plant species in Western Australia pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act; DPRID 2018).

Table 1: Vegetation associations within the Reserve

Vegetation description	Area occupied (ha)	Quadrat	Condition
ArJf - <i>Acacia rostellifera</i> and <i>Jacksonia furcellata</i> open shrubland over <i>*Bromus diandrus</i> open grassland over <i>*Euphorbia terracina</i> <i>*Pelargonium capitatum</i> and <i>Senecio pinnatifolius</i> sparse forbland over <i>Lepidosperma pubisquameum</i> sparse sedgeland.	0.65	ELA01; ELA02; ELA03	Good



Vegetation description	Area occupied (ha)	Quadrat	Condition
<p>Revegetation - <i>Eucalyptus gomphocephala</i> (Tuart), <i>Eucalyptus camaldulensis</i> and <i>Agonis flexuosa</i> var. <i>flexuosa</i> over grass weeds. Other planted species include *<i>Casuarina glauca</i>.</p> <p>Remnant trees also present.</p>	1.47	Releve 01	Completely Degraded
			
<p>Cleared: Previously cleared area used for playing fields, tracks etc.</p>	4.76	N/A	Completely Degraded
			

Figure 2: Vegetation Association



Legend

Koorana Reserve

Parkland

Track

Vegetation association

Revegetation area

ArJf

0 20 40 80

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

eco

logical

AUSTRALIA

www.ecoaus.com.au

Prepared by: SM Date: 25/10/2018

Figure 3: Vegetation Condition



Legend

Koorana Reserve

Parkland

Track

Vegetation condition

Good

Degraded

Completely degraded

0204080

Metres

Datum/Projection:

GDA 1994 MGA Zone 50

N

eco

logical

AUSTRALIA

www.ecoaus.com.au

Prepared by: SM Date: 25/10/2018

Fauna

A total of ten fauna species were recorded within the Reserve including eight birds, one mammal and one reptile. A fauna species list is provided in **Appendix D**.

No Commonwealth or State listed Threatened or Priority fauna species were recorded within the Reserve. Of the 69 conservation listed fauna species identified in the desktop assessment as possibly occurring within the Reserve, 11 species were found to have the potential to occur. This assessment is based on availability of suitable habitat, proximity of previous records and adequate survey effort.

The fauna likelihood of occurrence assessment is presented in **Appendix E**. Marine, migratory marine and migratory wetland species have been excluded from the assessment as the Reserve is not located in a marine or wetland area.

One introduced fauna species, *Feils catus* (Cat) was recorded as occurring within the Reserve.

The Reserve contained two broad fauna habitat types as depicted in **Figure 4**:

- Fauna habitat type 1: *Acacia rostellifera* and *Jacksonia furcellata* open shrubland; and
- Fauna habitat type 2: Revegetation area comprised of tall *Eucalyptus gomphocephala* (Tuart), *Eucalyptus camaldulensis* and *Agonis flexuosa* var. *flexuosa* over grass weeds.

Black cockatoo habitat assessment

No black cockatoos were observed within the Reserve at the time of assessment.

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area.

Black cockatoo foraging habitat has been determined using vegetation associations defined in the vegetation assessment. The quality of foraging habitat for black cockatoo species within the Reserve (as defined in **Table 2** below) has been assessed based on the availability and density of plant food sources. As with vegetation condition, foraging quality is not uniform throughout an entire vegetation association and these variations have been accounted for within the assessment. Where habitat quality falls between two scores, a conservative approach has been taken and the higher of the two scores has been used.

Table 2: Definition of black cockatoo foraging habitat quality.

Foraging quality	Justification
Excellent	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (e.g. canopy and midstorey).
Moderate	Moderate foraging value density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 20-40%) and food sources only present at one or two strata (e.g. canopy and midstorey).

Foraging quality	Justification
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (e.g. canopy).
Very poor	Very low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species <10%) and presence of food sources at only one stratum (e.g. canopy).
Nil	Cleared areas or no suitable vegetation present.

Table 3 contains a summary of each vegetation association occurring within the Reserve and its respective foraging quality score. Vegetation within the Reserve only provides foraging habitat for CBC. No suitable foraging species are present for BBC and FRTBC. No signs of foraging were observed within the Reserve. These results are depicted in **Figure 5**.

Table 3: Vegetation types and Carnaby's Black-Cockatoo foraging habitat quality within the Reserve

Vegetation community	Assessed foraging quality	Justification	Area impacted (ha)
ArJf	Very poor	Limited foraging species, primarily <i>Jacksonia furcellata</i> .	0.65
Revegetation	Good	Foraging habitat limited to Eucalyptus species, <i>Agonis flexuosa</i> and <i>Jacksonia furcellata</i> .	1.47
Cleared	Nil	No suitable foraging species	4.76

'Breeding habitat' for black cockatoos is defined in DSEWPac (2012) as trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow (> 300 mm for salmon gum and wandoo, and >500 mm for other species). These trees are known as significant trees. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). Significant trees which contain hollows that have an entrance diameter of more than 100 mm are suitable for use by black cockatoos (Whitford & Williams 2002). In general, hollows of sufficient size to support black-cockatoos do not form until trees are at least 230 years old, and the majority of nests are found in 300-500 year old trees (Johnstone 2006).

The black cockatoo breeding habitat assessment identified 12 potentially significant remnant Tuart trees within the reserve (**Table 4; Figure 5**). None of these trees contained a hollow of sufficient size to be utilised by black cockatoos for breeding purposes.


Table 4: Potentially significant black cockatoo habitat trees within the Reserve


Tree number	Species	Hollows noted	Diameter at Breast Height (DBH; mm)
1	<i>Eucalyptus gomphocephala</i>	No hollows	700
2	<i>Eucalyptus gomphocephala</i>	No hollows	600
3	<i>Eucalyptus gomphocephala</i>	No hollows	500
4	<i>Eucalyptus gomphocephala</i>	No hollows	800
5	<i>Eucalyptus gomphocephala</i>	No hollows	500
6	<i>Eucalyptus gomphocephala</i>	No hollows	600
7	<i>Eucalyptus gomphocephala</i>	No hollows	500
8	<i>Eucalyptus gomphocephala</i>	No hollows	650
9	<i>Eucalyptus gomphocephala</i>	No hollows	550
10	<i>Eucalyptus gomphocephala</i>	No hollows	500
11	<i>Eucalyptus camaldulensis</i>	No hollows	600
12	<i>Eucalyptus gomphocephala</i>	No hollows	750

Figure 4: Fauna Habitat





Legend

 Koorana Reserve

 Track

Fauna habitat

 Habitat 1: *Acacia rostellifera* and *Jacksonia furcellata* open shrubland


 Habitat 2: Revegetation area comprised of tall *Eucalyptus gomphocephala* (Tuart), *Eucalyptus camaldulensis* and *Agonis flexuosa* var. *flexuosa* over grass weeds

0 20 40 80

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N



eco logical
AUSTRALIA

www.ecoaus.com.au

Prepared by: SM Date: 25/10/2018

Figure 5: Black Cockatoo Habitat



Legend

- Koorana Reserve
- Track
- Potentially significant black cockatoo habitat tree - *Eucalyptus gomphocephala*

Black Cockatoo habitat quality

- Good
- Very poor

0 20 40 80
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

eco logical AUSTRALIA
www.ecoaus.com.au
Prepared by: SM Date: 25/10/2018

Summary

The remnant vegetation (0.65 ha) within the reserve has been subject to degradation over a prolonged period and consequently, is not a high-quality representation of the vegetation of the Swan Coastal plain bioregion. The other areas within the reserve are comprised of modified revegetation areas with remnant trees (1.47 ha) and playing fields/tracks (4.76 ha).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by DBCA (2018) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the reserve. The primarily degraded habitat within the Reserve is unlikely to support any of the conservation significant species identified in the desktop searches.

Three vegetation associations were identified within the reserve. Only one of these associations, (ArJf), is a remnant of its' native structure and composition and is well represented in the broader area. The other two associations represent revegetation and cleared areas. None of the associations resemble any known Threatened Ecological Communities (TECs) listed under the EPBC Act or Priority Ecological Communities (PECs) listed by DBCA. Vegetation condition within the associations ranged from Completely Degraded to Good based on which is consistent with the significant disturbance as noted throughout the reserve. The remnant vegetation (ArJf) is in good condition.

No Commonwealth or State listed Threatened or Priority fauna species were recorded within the reserve. Eleven conservation listed fauna species were considered potential to occur. Although these species are considered potential to occur, the Reserve is not considered to comprise core habitat which these species would be solely reliant on.

One introduced fauna species was recorded in the reserve: *Felis catus* (Cat). The reserve contained two broad fauna habitat types: Fauna habitat type 1: *Acacia rostellifera* and *Jacksonia furcellata* open shrubland; and Fauna habitat type 2: Revegetation area comprised of tall *Eucalyptus gomphocephala* (Tuart), *Eucalyptus camaldulensis* and *Agonis flexuosa* var. *flexuosa* over grass weeds.

No black cockatoos or signs of foraging were observed within the reserve at the time of assessment. Vegetation within the reserve provides foraging habitat for Carnaby's Black-Cockatoo. This habitat quality is predominantly very poor within native vegetation (0.65 ha), however ranges to good within revegetated areas (1.47 ha) due to the presence of large eucalypts and other foraging species. No suitable foraging species are present within the reserve for Baudin's Black-Cockatoo or Forest Red-tailed Black-Cockatoo. Twelve potentially significant remnant trees were identified within the reserve, however none of these trees contained a hollow of sufficient size to be utilised by black cockatoos for breeding purposes.

References

Beard, J. 1981. *Vegetation of the Perth area, Western Australia: map and explanatory memoir, 1:250 000 series*, Vegmap Publications, Perth.

Beard, J. 1990. *Plant Life of Western Australia*. Kangaroo Press, Perth.

Bureau of Meteorology (BoM). 2018. *Climate Data Online: Monthly Rainfall: Hopelands*. Available from: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=009253. Accessed September 2018.

Department of Biodiversity, Conservation and Attractions (DBCA). 2007 - 2018. *NatureMap*. Department of Parks and Wildlife and WA Museum. Available from: <http://naturemap.dpaw.wa.gov.au/default.aspx>. Accessed August 2018.

Department of Biodiversity Conservation and Attractions (DBCA). 2018. *Wildlife Conservation (Threatened Flora) Notice 2017*. Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/fauna_notice.pdf. Accessed September 2018.

Department of Primary Industries and Regional Development (DPRID). 2018. *Western Australian Organism List: Declared Pests*. Available from: https://www.agric.wa.gov.au/organisms?search_string=%2A&ref_code_name=PER-DP. Accessed September 2018

Department of Sustainability, Environment, Water, Population and Communities (DSEWPoC). 2012. *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*; Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*; Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii* naso*. Australian Government.

Department of the Environment and Energy (DotEE). 2018a. *EPBC Act Protected Matters Search Tool*. Available from: <http://www.environment.gov.au/epbc/pmst/index.html>. Accessed August 2018.

Department of the Environment and Energy (DotEE). 2018b. *Interim Biogeographic Regionalisation for Australia, Version 7*. Available from: <http://www.environment.gov.au/land/nrs/science/ibra>. Accessed September 2018.

Department of the Environment and Energy (DotEE). 2018c. *Species Profiles and Threats Database*. Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>. Accessed September 2018.

Department of Water and Environmental Regulation (DWER). 2018. *Perth Groundwater Map*. Available from: <http://www.water.wa.gov.au/maps-and-data/maps/perth-groundwater-atlas>. Accessed September 2018.

Environmental Protection Authority (EPA). 2016a. *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*. Perth, Western Australia.

Environmental Protection Authority (EPA). 2016b. *Technical Guidance: Terrestrial Fauna Surveys*. Perth, Western Australia.

- Finn, H. 2012. *Assessment of habitat values for black-cockatoos within selected sites at Newmont Boddington Gold Mine*. Report prepared for Newmont Boddington Gold Pty Ltd.
- Geological Survey of Western Australia. (GSWA). 1978. *Geological Series, Perth WA 1:250,000 Environmental Geology Series*. Geological Survey of Western Australia.
- Hedde, E.M., Loneragan D.W., & Havel J.J. 1980. 'Vegetation complexes of the Darling System, Western Australia', in: *Atlas of natural resources of the Darling System, Western Australia*. Perth, Western Australia.
- International Union for Conservation of Nature (IUCN). 2018. *The IUCN Red List of Threatened Species*. Available from: <http://www.iucnredlist.org/>. Accessed September 2018.
- Johnstone, R. 2006. *Going, going, gone! Veteran and stag trees: a valuable resource*. Western Australian Museum, Perth.
- Marchant, S. & Higgins, P.J. 1990. *Handbook of Australian, New Zealand & Antarctic birds*. Oxford University Press, Melbourne.
- McKenzie, N.L., May, J.E. & McKenna, S. 2003. *Bioregional Summary of the 2002 Biodiversity Audit of Western Australia*. Department of Conservation and Land Management, Perth, Western Australia.
- Mitchell D., Williams K. & Desmond A. 2002. 'Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)', in *A biodiversity audit of Western Australia's 53 Biogeographical Subregions in 2002*, eds Department of Conservation and Land Management, Perth, pp. 606-623.
- New South Wales Office of Environment & Heritage (NSW OEH). 2018. *Blue-billed Duck – Profile*. Available from: <https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10580>. Accessed September 2018.
- Western Australian Herbarium. 1998-. *FloraBase – the Western Australian Flora*. Available from: <https://florabase.dpaw.wa.gov.au/>. Accessed August 2018.
- Whitford, K.R. & Williams, M.R. 2002. 'Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees II: Selecting trees to retain for hollow dependent fauna'. *Forest Ecology and Management*. vol. 160: pp. 215-232.

Appendix A: Flora species list

Family	Species
Apocynaceae	* <i>Gomphocarpus fruticosus</i>
Asparagaceae	<i>Acanthocarpus preissii</i>
	<i>Lomandra maritima</i>
Asphodelaceae	* <i>Trachyandra divaricata</i>
Asteraceae	* <i>Hypochaeris glabra</i>
	<i>Senecio pinnatifolius</i>
	* <i>Sonchus oleraceus</i>
Brassicaceae	* <i>Brassica tournefortii</i>
Casuarinaceae	* <i>Casuarina glauca</i> (planted)
Cyperaceae	<i>Lepidosperma pubisquameum</i>
Ericaceae	<i>Leucopogon parviflorus</i>
Euphorbiaceae	* <i>Euphorbia terracina</i>
	<i>Adriana quadripartita</i>
Fabaceae	* <i>Medicago polymorpha</i>
	<i>Acacia cochlearis</i>
	<i>Acacia cyclops</i> (planted)
	<i>Acacia rostellifera</i>
	<i>Acacia saligna</i>
	<i>Hardenbergia comptoniana</i>
	<i>Jacksonia furcellata</i>
	<i>Kennedia prostrata</i>
Geraniaceae	* <i>Pelargonium capitatum</i>
Goodeniaceae	<i>Scaevola nitida</i>
Haemodoraceae	<i>Conostylis</i> sp.
Hemerocallidaceae	<i>Dianella revoluta</i>
Myrtaceae	<i>Agonis flexuosa</i> var. <i>flexuosa</i> (planted)
	<i>Eucalyptus camaldulensis</i> (planted)
	<i>Eucalyptus gomphocephala</i> (planted)
	<i>Eucalyptus rudis</i> (planted)
	<i>Melaleuca lanceolata</i> (planted)

Family	Species
	<i>Melaleuca nesophila</i> (planted)
Papaveraceae	* <i>Fumaria capreolata</i>
Phyllanthaceae	<i>Phyllanthus calycinus</i>
Poaceae	* <i>Avena barbata</i>
	* <i>Bromus diandrus</i>
	* <i>Lagurus ovatus</i>
	<i>Austrostipa flavescens</i>
	* <i>Ehrharta calycina</i>
	* <i>Ehrharta longiflora</i>
	* <i>Lolium perenne</i>
Primulaceae	* <i>Lysimachia arvensis</i>
Proteaceae	<i>Hakea prostrata</i>
	<i>Hakea varia</i>
Ranunculaceae	<i>Clematis linearifolia</i>
Restionaceae	<i>Desmocladius flexuosus</i>
Rubiaceae	<i>Opercularia vaginata</i>

Appendix B: Quadrat and relevé site data

Site number	Date	Site type	Observer
ELA01 (Quadrat)	28/09/2018	Quadrat	JC
Landscape type	Soils	Easting	Northing
Dune	Grey sand	0383947	6420631
Soil condition	Fire	Condition	Disturbance
Moist	4-5 years	Good	Weeds



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Height
<i>Leucopogon parviflorus</i> (Coast Beard-heath)	2	L	0.8
<i>Acacia rostellifera</i> (Summer-scented Wattle)	35	M	0.9
<i>Jacksonia furcellata</i> (Grey Stinkwood)	2	M	1
<i>Lomandra maritima</i>	3	L	0.3
<i>Acanthocarpus preissii</i>	4	L	0.3
<i>Lepidosperma pubisquameum</i>	5	L	0.3

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Height
<i>Conostylis sp</i>	0.5	L	0.2
* <i>Avena barbata</i> (Bearded Oat)	0.1	L	0.2
* <i>Pelargonium capitatum</i> (Rose Pelargonium)	2	L	0.3
<i>Senecio pinnatifolius</i>	5	L	0.3
* <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	15	L	0.3
* <i>Bromus diandrus</i> (Great Brome)	15	L	0.3
<i>Scaevola nitida</i> (Shining Fanflower)	2	L	0.5
* <i>Lagurus ovatus</i> (Hare's Tail Grass)	0.5	L	0.2
* <i>Lysimachia arvensis</i> (Pimpernel)	0.1	L	0.1
* <i>Casuarina glauca</i>	0.1	M	1.5
<i>Dianella revoluta</i>	0.1	L	0.4
<i>Opercularia vaginata</i> (Dog Weed)	0.1	L	0.2
<i>Desmocladius flexuosus</i>	0.1	L	0.15
* <i>Hypochaeris glabra</i> (Smooth Catsear)	0.1	L	0.1

Site number	Date	Site type	Observer
ELA02 (Quadrat)	28/09/2018	Quadrat	JC
Landscape type	Soils	Easting	Northing
Dune	Grey sand	0383996	6420651
Soil condition	Fire	Condition	Disturbance
Moist	4-5 years	Good	Weeds



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Acacia rostellifera</i> (Summer-scented Wattle)	15	M	0.5
<i>Jacksonia furcellata</i> (Grey Stinkwood)	2	M	1
<i>Lomandra maritima</i>	0.5	L	0.4
<i>Acanthocarpus preissii</i>	2	L	0.3
<i>Lepidosperma pubisquameum</i>	15	L	0.3
<i>Conostylis</i> sp	0.1	L	0.2
* <i>Pelargonium capitatum</i> (Rose Pelargonium)	0.5	L	0.3
<i>Senecio pinnatifolius</i>	5	L	0.15

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>*Euphorbia terracina</i> (Geraldton Carnation Weed)	30	L	0.2
<i>*Bromus diandrus</i> (Great Brome)	15	L	0.3
<i>Scaevola nitida</i> (Shining Fanflower)	5	L	0.5
<i>*Lysimachia arvensis</i> (Pimpernel)	0.1	L	0.1
<i>*Casuarina glauca</i>	0.1	M	1.5
<i>Dianella revoluta</i>	0.1	L	0.15
<i>Opercularia vaginata</i> (Dog Weed)	0.1	L	0.2
<i>Desmocladius flexuosus</i>	0.1	L	0.15
<i>Adriana quadripartita</i> (Bitter Bush)	4	M	1.2
<i>Austrostipa flavescens</i>	0.1	L	0.6
<i>Kennedia prostrata</i> (Scarlet Runner)	0.1	L	0.15
<i>*Medicago polymorpha</i> (Burr Medic)	0.1	L	0.15
<i>Hardenbergia comptoniana</i> (Native Wisteria)	0.1	L	0.4

Site number	Date	Site type	Observer
ELA03 (Quadrat)	28/09/2018	Quadrat	JC
Landscape type	Soils	Easting	Northing
Dune	Grey sand	0383971	6420683
Soil condition	Fire	Condition	Disturbance
Moist	4-5 years	Good	Weeds



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>Acacia rostellifera</i> (Summer-scented Wattle)	18	M	0.5
<i>Jacksonia furcellata</i> (Grey Stinkwood)	2	M	1
<i>Lomandra maritima</i>	02	L	0.4
<i>Acanthocarpus preissii</i>	4	L	0.3
<i>Lepidosperma pubisquameum</i>	10	L	0.3
<i>Conostylis sp</i>	0.1	L	0.2
* <i>Avena barbata</i>	2	L	0.3
* <i>Pelargonium capitatum</i> (Rose Pelargonium)	10	L	0.3
<i>Senecio pinnatifolius</i>	8	L	0.15
* <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	2	L	0.2

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Sub-Stratum
<i>*Bromus diandrus</i> (Great Brome)	40	L	0.3
<i>Scaevola nitida</i> (Shining Fanflower)	0.5	L	0.5
<i>*Lagurus ovatus</i> (Hare's Tail Grass)	0.1	L	0.2
<i>*Casuarina glauca</i>	1	M	1.5
<i>Dianella revoluta</i>	0.1	L	0.15
<i>Desmocladius flexuosus</i>	0.1	L	0.15
<i>Austrostipa flavescens</i>	1	L	0.6
<i>Hakea prostrata</i> (Harsh Hakea)	0.1	M	1.5
<i>Phyllanthus calycinus</i> (False Boronia)	0.1	L	0.4

Opportunistic collections for species list

Gomphocarpus fruticosus (Narrowleaf Cottonbush) Declared Pest Plant

Acacia cochlearis (Rigid Wattle)

Acacia saligna (Orange Wattle)

Ehrharta calycina (Perennial Veldt Grass)

Trachyandra divaricata

Lolium perenne (Perennial Ryegrass)

Brassica tournefortii (Mediterranean Turnip)

Hakea varia (Variable-leaved Hakea)

Eucalyptus rudis (Flooded Gum) planted

Melaleuca lanceolata (Rottnest Teatree) planted

Fumaria capreolata (Whiteflower Fumitory)

Acacia cyclops (Coastal Wattle) planted

Agonis flexuosa var. *flexuosa* planted

Clematis linearifolia

Melaleuca nesophila (planted)

Site number	Date	Site type	Observer
Releve 01	28/09/2018	Releve	JC
Landscape type	Soils	Easting	Northing
Dune	Grey sand	0384024	6420758
Soil condition	Fire	Condition	Disturbance
Moist	4-5 years	Degraded	Weeds, previously cleared, historic revegetated area



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Height
<i>Eucalyptus gomphocephala</i> (Tuart) planted	20	U	20
* <i>Casuarina glauca</i> planted	0.1	U	12
<i>Eucalyptus rudis</i> (Flooded Gum) planted	0.1	U	12
<i>Acanthocarpus preissii</i>	0.1	L	0.3
<i>Ehrharta longiflora</i> (Annual Veldt Grass)	90	L	0.3
<i>Phyllanthus calycinus</i> (False Boronia)	1	L	0.4
<i>Jacksonia furcellata</i> (Grey Stinkwood)	1	L	0.8
* <i>Pelargonium capitatum</i> (Rose Pelargonium)	1	L	0.5

Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Height
<i>Sonchus oleraceus</i> (Common Sowthistle)	0.1	L	0.3

Site number	Date	Site type	Observer
Releve 02	28/09/2018	Releve	JC
Landscape type	Soils	Easting	Northing
Dune	Grey sand	0383989	6420748
Soil condition	Fire	Condition	Disturbance
Moist	4-5 years	Completely Degraded	Weeds, previously cleared, revegetated area



Species	Cover (%)	Stratum (U=Upper, M=Middle, L=Low)	Height
<i>Agonis flexuosa</i> var. <i>flexuosa</i> planted	5	U	10
<i>Eucalyptus camaldulensis</i> planted	15	U	10
<i>Jacksonia furcellata</i> (Grey Stinkwood)	1	L	1.5
<i>Ehrharta longiflora</i> (Annual Veldt Grass)	85	L	0.3
* <i>Bromus diandrus</i> (Great Brome)	5	L	0.3
<i>Fumaria capreolata</i> (Whiteflower Fumitory)	2	L	0.2
<i>Acanthocarpus preissii</i>	2	L	0.2
* <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	2	L	0.2

Appendix C: Flora likelihood of occurrence assessment

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	S1	PMST	A sub-shrub ranging from 0.25-0.65 tall. Flowers are yellow in colour, narrow, hairy and are openly spaced. Flowering occurs from September through to November. It can be found on areas with clayey-sand with lateritic pebbles and prefers low woodland areas that are situated near winter flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	CR	S1	PMST	This species is a clumped subshrub reaching a height of up to 0.6 m. Flowers are yellow in colour, narrow, hairy and are openly spaced. Flowering occurs from late August through to November. Habitat for this species is grey-brown sandy loams to clay soil occurring on predominately flat, seasonally wet terrain (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Andersonia gracilis</i>	EN	-	PMST	Slender erect or open straggly shrub grows to 0.1-0.5(-1) m high. Grows in white/grey sand, sandy clay, gravelly loam in winter-wet areas and near swamps (Western Australian Herbarium 1998 -).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Caladenia huegelii</i>	EN	S1	PMST; NatureMap	A slender orchid 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils of the Bassendean and Spearwood systems in low mixed Banksia, <i>Allocasuarina</i> and Jarrah woodlands (Western Australian Herbarium 1998-, DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diuris purdiei</i>	EN	S2	PMST	A slender orchid to 0.35 m tall. Flowers are yellow and visible from September to October. Habitat for this species is grey-black sand substrates in winter-wet swamps which have high moisture (Western Australian Herbarium 1998-). It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent <i>Melaleuca preissiana</i> , <i>Corymbia calophylla</i> , <i>E. marginata</i> and <i>Nuytsia floribunda</i> (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Drakaea elastica</i>	EN	S1	PMST	A slender flower stem up to 30 cm high with a single glossy green, heart shaped leaf. The single flower is 3 to 4 cm long. It can be found on bare patches of sand within dense vegetation in low lying winter-wet swamps. <i>D. elastica</i> often occurs with other orchid species (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Eucalyptus x balanites</i>	EN	S1	PMST	A mallee up to 500 cm tall with rough, flaky bark. Flowers are white, occurring from October to December or January to February. Habitat for this species occurs in sandy soils with lateritic gravel (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Lepidosperma rostratum</i>	EN	S2	PMST	A clumped, rhizomatous herb that grows to roughly 30 cm in diameter and 50 cm in height. The flowers are brown in colour and the plant can be seen to flower between May and June. This plant can be found amongst low heath in winter-wet swamps in peaty sand and clay substrate (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Diuris micrantha</i>	VU	S3	PMST	A slender orchid to 60 cm tall. Flowers are yellow with reddish-brown markings and visible from September to October. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Drakaea micrantha</i>	VU	S2	PMST	A tuberous, terrestrial herb which has a diminutive red and yellow flower, 1.2–2.5 cm long, on a stem that grows to 30 cm. Flowering occurs from September to October. Its heart-shaped leaf, about 1.5 cm long, is silvery grey with prominent green veins. Habitat for this species occurs within cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed in lower lying areas near wetlands under Spearwood (<i>Kunzea glabrescens</i>) thickets (Western Australian Herbarium 1998-, DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Acacia benthamii</i>	-	P2	Nature Map	Shrub to 1 m tall. Flowers are yellow, visible from August to September. Habitat for this species is sand overlying limestone breakaways (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	-	P3	Nature Map	Limited habitat information available. Known from coastal areas (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Calandrinia oraria</i>	-	P3	Nature Map	Limited habitat information available. Known from coastal areas (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species
<i>Dillwynia dillwynioides</i>	-	P3	Nature Map	A decumbent or erect, slender shrub between 30-120 cm tall. Flowers are red & yellow/orange and visible from August to December. Habitat for this species occurs on sandy soils in winter-wet depressions (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Schoenus capillifolius</i>	-	P3	Nature Map	A semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Flowers are green, occurring from October to November. Habitat for this species includes brown mud and claypans (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Sphaerolobium calcicola</i>	-	P3	Nature Map	Slender multi-stemmed shrub (scandent or erect) to 1.5 m tall. Flowers are orange-red and visible in June or from September to November (Western Australian Herbarium 1998-). Habitat for this species is white-grey-brown sand over limestone or sandy clay substrate over black-peaty-sandy-clay. This species has been found to occur on tall dunes, and in low-lying areas including interdunal swamps and winter-wet flats (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Dodonaea hackettiana</i>	-	P4	Nature Map	A straight, tall shrub reaching 1-5 m in height. Has a yellow-green/red flower that generally blooms from July to October. It can be found in areas of sand and along outcropping limestone (Western Australian Herbarium 1998-)	Does not occur	Adequate survey effort did not record this species
<i>Jacksonia sericea</i>	-	P4	Nature Map	Low spreading shrub to 60 cm tall. Flowers are orange and visible December or January or February. Habitat for this species is calcareous and sandy soils (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Stylidium longitubum</i>	-	P4	Nature Map	Erect annual (ephemeral), herb grows 0.05-0.12 m high. Flowers October to December. Grows in sandy clay, clay in seasonal wetlands (Western Australian Herbarium 1998-).	Highly unlikely	Preferred habitat does not occur

¹Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

CR = listed as Critically Endangered under the EPBC Act.

EN = listed as Endangered under the EPBC Act.

VU = listed as Vulnerable under the EPBC Act.

²Species listed in Western Australia under the *Wildlife Conservation Act 1950* (WC Act) or by the Department of Biodiversity, Conservation and Attractions (DBCA).

S1 = Schedule 1: Flora that are considered likely to become extinct or rare, as critically endangered flora (CR) under the WC Act.

S2 = Schedule 2: Flora that are considered likely to become extinct or rare, as endangered flora (EN) under the WC Act.

S3 = Schedule 3: Flora that are considered likely to become extinct or rare, as vulnerable flora (VU) under the WC Act.

P1 = Priority 1: Poorly-known species – species that are known from one or a few locations (generally five or less) which are potentially at risk (DBCA).

P2 = Priority 2: Poorly-known species – species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation (DBCA).

P3 = Priority 3: Poorly known species – species that are known from several locations, and the species does not appear to be under imminent threat (DBCA).

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring (DBCA).

³NatureMap = NatureMap database search (DBCA 2007-2018).

PMST = EPBC Act Protected Matters Search Tool (DotEE 2018).

Appendix D: Fauna species list

Species	Common name
Birds	
<i>Barnardius zonarius</i>	Australian Ringneck
<i>Lichmera indistincta</i>	Brown Honeyeater
<i>Anthochaera carunculata</i>	Red Wattle Bird
<i>Rhipidura leucophrys</i>	Willy Wagtail
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Gavicalis virescens</i>	Singing Honeyeater
<i>Corvus coronoides</i>	Australian Raven
<i>Gymnorhina tibicen</i>	Australian Magpie
Mammals	
<i>Felis catus</i>	Cat
Reptiles	
<i>Tiliqua rugosa</i>	Bobtail

Appendix E: Fauna likelihood of occurrence assessment

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris ferruginea</i>	CR	S3	NatureMap; PMST	This species is migratory. Known habitat includes intertidal mudflats in sheltered coastal areas, such as estuaries and non-tidal swamps and lakes near the coast. The species has been recorded less often inland around lakes, dams and bore drains with bare edges of mud or sand. The distribution of the species is limited by land clearing and disturbance at roost and feeding sites (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Limosa lapponica menzbieri</i>	CR	S3	PMST	This species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and salt works, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Numenius madagascariensis</i>	CR & IA	VU	PMST	This species is migratory with a primarily coastal distribution and is commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Pseudocheirus occidentalis</i>	CR	S1	PMST	This species is an arboreal species, preferring areas of Peppermint (<i>Agonis flexuosa</i>) woodlands and peppermint/tuart associations. This species generally prefers areas of higher water content, predominately inhabiting areas of the south-western corner of Western Australia (DotEE 2018c).	Potential	Preferred habitat is present.
<i>Bettongia penicillata ogilbyi</i>	EN	S1	PMST	Open forest and woodland with a low understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands. The species has been reduced to 1% of its' pre-European range and currently only exists in isolated pockets in uninhabited vegetation (DotEE 2018c).	Does not occur	Species does not occur on the Swan Coastal Plain
<i>Botaurus poiciloptilus</i>	EN	S2	PMST	Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours 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. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. <i>Phragmites</i> , <i>Cyperus</i> , <i>Eleocharis</i> , <i>Juncus</i> , <i>Typha</i> , <i>Baumea</i> , <i>Bolboschoenus</i>) or cutting grass (<i>Gahnia</i>) growing over muddy or peaty substrate (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris canutus</i>	EN & IA	V	PMST	This species is migratory. During the non-breeding season in Australasia, the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. They are occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and salt works (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calyptorhynchus baudinii</i>	EN	S2	PMST	Baudin's Cockatoo occurs in south-west Western Australia. The range of the species, which is generally bounded by the 750-mm isohyet, extends from Albany northward to Gidjegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Kojonup. Habitat for this species mainly occurs in eucalypt forests, especially Jarrah, Marri and Karri forest. The species is less frequently in woodlands of wandoo (<i>E. wandoo</i>), blackbutt (<i>E. patens</i>), flooded gum (<i>E. rudis</i>), yate (<i>E. cornuta</i>), partly cleared farmlands and urban areas, including roadside trees and house gardens (DotEE 2018c).	Potential	On the edge of the species range
<i>Calyptorhynchus latirostris</i>	EN	S2	NatureMap; PMST	Known habitat includes remnant eucalypt woodlands, and shrubland or Kwongan heathland dominated by proteaceous species. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for agriculture. Known to utilise <i>C. calophylla</i> , * <i>C. citriodora</i> , <i>E. patens</i> , <i>E. marginata</i> , <i>X. preissii</i> and <i>A. fraseriana</i> as a foraging plant, <i>C. calophylla</i> as breeding habitat and <i>C. calophylla</i> and <i>E. marginata</i> as roosting habitat (DotEE 2018c).	Likely	Preferred habitat likely to be present.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Diomedea amsterdamensis</i>	EN & IA	CR	PMST	A predominately marine species, preferring to nest in open patchy vegetation near exposed hillocks and ridges and when it is not breeding it will sleep and rest on the ocean waters (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diomedea dabbenena</i>	EN & IA	CR	PMST	A pelagic marine species that prefers to forage in open waters, and likes to rest and sleep amongst the open water when not breeding (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diomedea sanfordi</i>	EN & IA	S3	PMST	A marine species that prefers areas amongst the subantarctic, subtropical and Antarctic waters, preferring waters between 6-20°C. This species will generally nest on flat/gentle slopes in areas that are relatively exposed to allow for take-off and landing. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Isodon fusciventer</i>	EN	P4	NatureMap	Scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. On the Swan Coastal Plain, Quenda are often associated with wetlands (DotEE 2018c).	Possible	Species may utilise the habitat and occurs in the area
<i>Macronectes giganteus</i>	EN & IA	P4	PMST	The Southern Giant-Petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack-ice and onto the Antarctic continent (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Myrmecobius fasciatus</i>	EN	S2	NatureMap	Can be found in areas of Acacia woodlands, as well as in areas on sand plain and sand dune that are dominated by spinifex. The species can commonly be found in the south-west of Western Australia in areas of Eucalyptus woodlands and forests (DotEE 2018c)	Does not occur	Preferred habitat does not occur
<i>Rostratula australis</i>	EN	T	PMST	This species generally inhabits inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum <i>Muehlenbeckia</i> or canegrass or sometimes tea-tree (<i>Melaleuca</i>) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Anous melanops</i>	VU	S2	PMST	The Australian lesser noddy is only known to breed on the Houtman Abrolhos Islands. Birds appear to remain near the breeding islands all year. A population thought to be Australian lesser noddy possibly breeds on Ashmore Reef and may be colonising Cocos (Keeling) Island, however the subspecific identity has not been confirmed (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calyptrorhynchus banksii naso</i>	VU	S3	NatureMap; PMST	Known habitat includes remnant eucalypt woodlands, especially Jarrah, Marri and Karri forest. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for development or agriculture. Known to utilise <i>Corymbia calophylla</i> , <i>*Corymbia citriodora</i> , <i>Allocasuarina fraseriana</i> , <i>Eucalyptus patens</i> and <i>Eucalyptus marginata</i> as a foraging plant and <i>C. calophylla</i> as breeding habitat (DotEE 2018c).	Potential	May potentially utilise the Reserve, however no suitable foraging species present.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Charadrius leschenaultia</i>	VU & IA	V	PMST	The species is predominately a coastal species, preferring areas that are sheltered, sandy, shelly and/or muddy. As well as inshore reefs, small rocky islands and coral reefs. They are rarely spotted in shallow freshwater wetlands (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Dasyurus geoffroii</i>	VU	S3	PMST	Current habitat largely restricted to the southwest forests of WA. The species prefers to rest in hollow logs and earth burrows during the day, and will predominately forage along the ground at night. The distribution of the species is limited by land clearing and predation by feral cats and foxes (DotEE 2018c).	Unlikely	Species is unlikely to occur on the Swan Coastal Plain
<i>Diomedea epomophora</i>	VU & IA	S3	PMST	This species occurs in subantarctic, subtropical and occasionally Antarctic waters. It has been observed where the water temperature is between 6 to 20 degrees Celsius. It nests on flat, gently sloping ground on slopes, ridges, gullies and plateaux of large islands. Its nests are placed within vegetation that are sparse enough to enable easy access (DotEE 2018c)	Does not occur	Preferred habitat does not occur
<i>Diomedea exulans</i>	VU & IA	S1	PMST	This species is in marine, pelagic and aerial. It has been observed where the water temperature is between -2 to 24 degrees Celsius. In the Antarctic it rarely enters the ice belt. In Australasia this species occurs inshore, offshore and in pelagic waters. On breeding islands, it nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. It prefers open or patchy vegetation and nests in areas that are near exposed ridges or hillocks so that it can take off (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Halobaena caerulea</i>	VU	-	PMST	The blue petrel previously bred on Macquarie Island itself, but breeding is now restricted to offshore stacks near Macquarie Island (Garnett & Crowley 2000). Extraliminally, the blue petrel breeds on numerous other subantarctic islands in Indian and Atlantic Oceans including Crozet, Kerguelen, Marion, Prince Edward Island and South Georgia (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Leipoa ocellata</i>	VU	S3	PMST	This species is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as Broombush and Scrub Pine. In Western Australia, they are also found in some shrublands dominated by acacia, and occasionally in woodlands dominated by eucalypts (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Limosa lapponica baueri</i>	VU	S3	PMST	This species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and salt works, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Macronectes halli</i>	VU & IA	-	PMST	The Southern Giant-Petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack-ice and onto the Antarctic continent. The range of the Northern Giant-Petrel extends into subtropical waters mainly between winter and spring. It frequents both oceanic and inshore waters near breeding islands and in the non-breeding range (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Pachyptila turtur subantarctica</i>	VU	-	PMST	This species is marine, with breeding only known from two rock stacks off Macquarie Island. Habitat for this species is predominantly marine/coastal (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Phoebastria fusca</i>	VU	S2	PMST	The Sooty Albatross is a rare, but probably regular migrant to Australia, mostly in the autumn-winter months, occurring north to south-east Queensland, NSW, Victoria, Tasmania and South Australia (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pterodroma mollis</i>	VU	-	PMST	The Soft-plumaged Petrel is generally found over temperate and subantarctic waters in the South Atlantic, southern Indian and western South Pacific Oceans. The species is a regular and quite common visitor to southern Australian seas. The birds breed on islands off Tasmania, in the New Zealand region and in the Indian and South Atlantic Oceans and burrow among tussock grass and ferns on slopes and valleys (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Setonix brachyurus</i>	VU	S3	NatureMap	This species is a habitat specialist depending on its location whether that be on the mainland or restricted to its island population. On the mainland, the species prefers areas of complex vegetation structure of low, dense vegetation that provides protection from predation. The species prefers areas with high water availability year-round, preferring areas near riparian and swamp habitat (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Sternula nereis nereis</i>	VU	S3	PMST	This species nests on sandy beaches, spits and banks above the high tide line and below vegetation and roosts on beach at night. It is also found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche carteri</i>	VU	S2	PMST	The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean where it is particularly abundant off Western Australia. In the Australasian region, the species occupies inshore and offshore waters and nests on tussock-covered coastal cliffs and slopes, often in rocky situations (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche cauta cauta</i>	VU & IA	S3	PMST	The Shy Albatross is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current Off South America. The Shy Albatross preference for sea-surface temperatures is poorly known. In the southern Indian Ocean, the species has been observed over waters of 6.4-13.5°C (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche cauta steadi</i>	VU & IA	S3	PMST	This species is a marine bird that prefer waters found in the subantarctic and subtropical waters. The species can be observed in waters with a temperature ranging from 6.4°C-13.5°C. The White-capped Albatross is seen to nest on slopes with vegetation consisting of tussock and succulents (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Thalassarche impavida</i>	VU & IA	S3	PMST	The Campbell Albatross visits Australia in its non-breeding season where they are known to forage over the oceanic continental shelf preferring sub-Antarctic and subtropical waters. They can tolerate sea temperatures between 0-24°C (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche melanophris</i>	VU & IA	S2	PMST	This Albatross species inhabits Antarctic, subantarctic and temperate waters and is tolerant to a wide range of sea temperatures (0-24°C). The species is said to forage around the breaks of continental and island shelves and across nearby water banks (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Westralunio carteri</i>	VU	S3	NatureMap PMST	Species inhabits freshwater waterbodies.	Does not occur	Preferred habitat does not occur
<i>Actitis hypoleucos</i>	IA	-	NatureMap	This species is a migratory species. During the non-breeding season, the population migrates from the Russian far east. The Common Sandpiper mainly inhabit wetlands, predominately coastal but occasionally inland as well. This species is commonly found in areas of muddy margins or rocky shores where they forage with the protection of obstacles from varying substrates (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris acuminata</i>	IA	-	NatureMap	Habitat for this species is muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in salt works and sewage farms and use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calidris melanotos</i>	IA	-	NatureMap	This is a migratory species. Known habitat includes shallow wetlands either fresh or saline usually in coastal/near coastal habitats but can be found further inland. Prefers areas with low, emergent or fringing vegetation with open fringing mud flats. During the non-breeding season, the species occurs mainly the Eastern part of Australia, rarely being sighted in Western Australia (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris ruficollis</i>	IA	-	NatureMap	A migratory species that is found predominately in coastal areas such as sheltered inlets, bays, lagoons and estuaries. Occasionally they can be found on stony/rocky shores, reefs and flooded paddocks. They will usually feed in areas of intertidal mudflats or sandflats and generally in very shallow waters (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calidris subminuta</i>	IA	-	NatureMap	This species is typically found along the coast when present in Western Australia. It is predominately a terrestrial wetland species, preferring shallow freshwater/brackish wetlands. Has preference to areas of low vegetation such as rushes, sedges, samphire and short grasses (DotEE 2018b).	Does not occur	Preferred habitat does not occur
<i>Charadrius dubius</i>	IA	-	NatureMap	Is a vagrant species within Australia with an extremely large range. Prefers areas of sand banks, the shores of rivers, lakes, residual flood waters and areas of short grass. It is not likely for this species to inhabit coastal areas as it prefers lowland habitats (IUCN 2018).	Does not occur	Preferred habitat does not occur
<i>Chlidonias leucopterus</i>	IA	-	NatureMap	This species spends most of its time in Australia during its non-breeding season where it prefers coastal habitats. Within Western Australia the species can be found from Ballingup through to the Pilbara and Kimberley Regions, only venturing inland along major river systems (e.g. The Ord) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Gelochelidon nilotica</i>	IA	-	NatureMap	Preferring bare and sparsely vegetated islands, flats, dry mud and sand. This species can also be found amongst dune areas, saltmarshes, salt pans, rivers, marshes and swamps (DotEE 2018c)	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Limosa limosa</i>	IA	-	NatureMap	The Black-tailed Godwit is found to prefer coastal habitats within sheltered bays, estuaries and lagoons with intertidal mudflats and sandflats. The generally prefer areas with sparse vegetation such as salt marshes and salt flats. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pandion cristatus</i>	IA	-	NatureMap	The Osprey can be found in littoral and coastal habitats, as well as in terrestrial wetlands in tropical and temperature climate. They generally prefer coastal areas although can be seen to travel inland along major rivers (this normally occurs in northern Australia) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Phaethon rubricauda</i>	IA	P4	NatureMap	A migratory, marine species that generally occurs along the coast, breeding in cliffs and under bushes within the tropical climate of Australia (DotEE 2018c)	Does not occur	Preferred habitat does not occur
<i>Plegadis falcinellus</i>	IA	-	NatureMap	A migratory marine bird that prefers fresh water marshes that can be found along the edges of lakes, rivers, lagoons, flood-plains, sewage ponds and cultivated areas under irrigation. The species can also be found along coastal habitats such as estuaries, saltmarshes and coastal lagoons. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pluvialis fulva</i>	IA	-	NatureMap	This species generally occurs along the coastal areas of Australia, and occasionally amongst inland wetlands. They usually prefer areas long beaches and mudflats, as well as sand flats and sheltered areas such as harbours and estuaries. The tend not to inhabit terrestrial habitats, where sightings of this species are less common (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Pluvialis squatarola</i>	IA	-	NatureMap	Occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Tringa glareola</i>	IA	-	NatureMap	Uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. They are also found at some small wetlands only when they are drying (DotEE 2018c	Does not occur	Preferred habitat does not occur
<i>Tringa nebularia</i>	IA	-	NatureMap	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayment's, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and salt flats DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Tringa stagnatilis</i>	IA	-	NatureMap	This species is commonly found along coastal and inland wetlands within Australia. Within Western Australia records are scattered and are mainly found along the coast. They prefer permanent or ephemeral wetlands with varying salinity	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
				levels such as swamps, saltpans, saltmarshes, intertidal mudflats and estuaries (DotEE 2018c).		
<i>Xenus cinereus</i>	IA	-	NatureMap	The Terek Sandpiper generally forages in open, soft wet intertidal mudflats or within sheltered estuaries, harbours or embayments. They are rarely viewed near the edge of water, and may be found to roost amongst mangroves and perch in branches (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Falco peregrinus</i>	-	S	NatureMap	This species is able to tolerate a wide range of habitats, inhabiting both hot and cold climates, along with wet and dry areas. Nesting generally occurs amongst depressions in rock faces without nests (IUCN 2018)	Unlikely	Preferred habitat does not occur
<i>Falsistrellus mackenziei</i>	-	P4	NatureMap	Forests subject to high levels of rainfall that are generally dominated by tall trees such as Jarrah, Marri, Karri and Tuart, but has also been found within Banksia woodlands along the Swan Coastal Plain (IUCN 2018).	Does not occur	Preferred habitat does not occur
<i>Hydromys chrysogaster</i>	-	P4	NatureMap	Permanent fresh or brackish water, although it can also be found in marine environments, including coastal mangroves. The species occupies a wide variety of freshwater habitats, from subalpine streams and other inland waterways to lakes, swamps, and farm dams. Populations may be abundant in drainage swamps.	Does not occur	Preferred habitat does not occur
<i>Ixobrychus dubius</i>	-	P4	NatureMap	This species prefers areas consisting of reedbeds, dense freshwater swamps and well-fringed watercourses (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Notamacropus eugenii subsp. derbianus</i>	-	P4	NatureMap	Species habitat information unavailable.	Does not occur	Species has a restricted distribution on the WA mainland
<i>Notamacropus irma</i>	-	P4	NatureMap	The Western Brush Wallaby prefers areas of open forest or woodlands that are seasonally wet and have low vegetation. They prefer dry, sclerophyll forests such as mallee and jarrah, as well as heathland scrub (DotEE 2018c)	Does not occur	Species was not recorded with the study area not able to support this species
<i>Oxyura australis</i>	-	P4	NatureMap	Can be found in areas of deep, permanent wetlands and swamps with dense aquatic vegetation and predominately lives in the water, only leaving if disturbed or to move for breeding (NSW OEH 2018).	Does not occur	Preferred habitat does not occur
<i>Synemon gratiosa</i>	-	P4	NatureMap	This species is associated with a preferred host plant, the <i>Lomandra maritima</i> . This is especially evident in two habitats: 1. Coastal heathland on Quindalup dunes where it is restricted to the secondary dunes 2. Banksia woodland on Spearwood and Bassendean dunes. "(DotEE 2018c)	Potential	Preferred habitat is present.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Thinornis rubricollis</i>	-	P4	NatureMap	The hooded plover (western) inhabits ocean beaches and the edges of near-coastal and inland salt-lakes that may be hundreds of kilometres from the coast. It occasionally occurs inland from the edges of lakes, on nearby grassy freshwater seepages, and in estuaries. It appears nomadic, forming flocks of hundreds on inland lakes in the early breeding season and forming very large non-breeding flocks near coastal salt-lakes (Marchant & Higgins, 1990).	Does not occur	Preferred habitat does not occur
<i>Throscodectes xiphos</i>	-	P1	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available
<i>Lerista lineata</i>	-	P3	NatureMap	This species prefers areas of sandy coastal heath and low scrubland, as well as banksia woodland, tuart open woodland with deep sands and coastal dunes (although it is most dependent on substrate type rather than vegetation type) (DotEE 2018c)	Potential	Preferred habitat is present.
<i>Neelaps calonotos</i>	-	P3	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Tyto novaehollandiae</i> <i>subsp. novaehollandiae</i>	-	P3	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available
<i>Calyptorhynchus</i> sp. (white tailed black cockatoo)	-	T	NatureMap	The details of this <i>Calyptorhynchus</i> sp. can be found in the above descriptions of <i>Calyptorhynchus</i> species within this table.	N/A – refer to species specific assessments above.	

¹EPBC Act = Fauna listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

CR = listed as Critically Endangered under the EPBC Act

EN = listed as Endangered under the EPBC Act

VU = listed as Vulnerable under the EPBC Act

IA = listed as Migratory under the EPBC Act

²WC Act = Fauna listed under the *Wildlife Conservation Act 1950*.

S1 = Schedule 1: Fauna that is rare or likely to become extinct as critically endangered fauna (CR)

S2 = Schedule 2: Fauna that is rare or likely to become extinct as endangered fauna (EN)

S3 = Schedule 3: Fauna that is rare or likely to become extinct as vulnerable fauna (VU)

S5 = Schedule 5: Migratory birds listed under an international agreement

S7 = Schedule 7: Other specially protected fauna (OS)

³DBCA = Fauna listed as Priority species under the Department of Biodiversity, Conservation and Attractions

P1 = Species that are known from one or a few locations (generally five or less) which are potentially at risk. Listed by DBCA

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring. Listed by DBCA.

⁴NatureMap = NatureMap database search (DBCA 2007-2018)

PMST = EPBC Act Protected Matters Search Tool report (DotEE 2018).

Appendix B : Likelihood of Occurrence Criteria

Likelihood of Occurrence Criteria for Flora and Fauna of Conservation Significance

- Likelihood: Recorded.
 - The species has previously been recorded within Site from Parks and Wildlife database search results and/or from previous surveys of the Site, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
- Likelihood: Likely.
 - The species has not previously been recorded within the Site. However:
 - the species has been recorded in proximity (<5 km) to the Site, and occurs in similar habitat to that which occurs within the Site
 - core habitat and suitable landforms for the species occur within the Site either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present
 - there is a medium to high probability that a species uses the Site.
- Likelihood: Potential.
 - The species has not previously been recorded within the Site. However,
 - targeted surveys may locate the species based on records occurring in proximity to the Site (5-15 km) and suitable habitat occurring in the Site
 - the Site has been assessed as having potentially suitable habitat through habitat modelling
 - the species is known to be cryptic and may not have been detected despite extensive surveys
 - the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys.
 - The species has been recorded in the Site by a previous consultant survey or there is historical evidence of the species' occurrence within the Site. However,
 - doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution)
 - coordinates are doubtful.
- Likelihood: Unlikely.
 - The species has been recorded locally through Parks and Wildlife database searches. However, it has not been recorded within the Site and
 - it is unlikely to occur due to the Site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded
 - it is unlikely to occur due to few historical record/s and no other current collections in the local area.

- The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the Site through Parks and Wildlife database searches.
 - The species has not been recorded in the Site despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
- Likelihood: No.
 - The species is not known to occur within the bioregion based on current literature and distribution.
 - The Site lacks important habitat for a species that has highly selective habitat requirements.
 - The species has been historically recorded within Site or locally; however it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.

Appendix C : Flora likelihood of occurrence assessment

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	S1	PMST	A sub-shrub ranging from 0.25-0.65 tall. Flowers are yellow in colour, narrow, hairy and are openly spaced. Flowering occurs from September through to November. It can be found on areas with clayey-sand with lateritic pebbles and prefers low woodland areas that are situated near winter flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	CR	S1	PMST	This species is a clumped subshrub reaching a height of up to 0.6 m. Flowers are yellow in colour, narrow, hairy and are openly spaced. Flowering occurs from late August through to November. Habitat for this species is grey-brown sandy loams to clay soil occurring on predominately flat, seasonally wet terrain (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Andersonia gracilis</i>	EN	-	PMST	Slender erect or open straggly shrub grows to 0.1-0.5(-1) m high. Grows in white/grey sand, sandy clay, gravelly loam in winter-wet areas and near swamps (Western Australian Herbarium 1998 -).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Caladenia huegelii</i>	EN	S1	PMST; NatureMap	A slender orchid 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils of the Bassendean and Spearwood systems in low mixed Banksia, <i>Allocasuarina</i> and Jarrah woodlands (Western Australian Herbarium 1998-, DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diuris purdiei</i>	EN	S2	PMST	A slender orchid to 0.35 m tall. Flowers are yellow and visible from September to October. Habitat for this species is grey-black sand substrates in winter-wet swamps which have high moisture (Western Australian Herbarium 1998-). It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent <i>Melaleuca preissiana</i> , <i>Corymbia calophylla</i> , <i>E. marginata</i> and <i>Nuytsia floribunda</i> (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Drakaea elastica</i>	EN	S1	PMST	A slender flower stem up to 30 cm high with a single glossy green, heart shaped leaf. The single flower is 3 to 4 cm long. It can be found on bare patches of sand within dense vegetation in low lying winter-wet swamps. <i>D. elastica</i> often occurs with other orchid species (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Eucalyptus x balanites</i>	EN	S1	PMST	A mallee up to 500 cm tall with rough, flaky bark. Flowers are white, occurring from October to December or January to February. Habitat for this species occurs in sandy soils with lateritic gravel (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Lepidosperma rostratum</i>	EN	S2	PMST	A clumped, rhizomatous herb that grows to roughly 30 cm in diameter and 50 cm in height. The flowers are brown in colour and the plant can be seen to flower between May and June. This plant can be found amongst low heath in winter-wet swamps in peaty sand and clay substrate (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Diuris micrantha</i>	VU	S3	PMST	A slender orchid to 60 cm tall. Flowers are yellow with reddish-brown markings and visible from September to October. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Drakaea micrantha</i>	VU	S2	PMST	A tuberous, terrestrial herb which has a diminutive red and yellow flower, 1.2–2.5 cm long, on a stem that grows to 30 cm. Flowering occurs from September to October. Its heart-shaped leaf, about 1.5 cm long, is silvery grey with prominent green veins. Habitat for this species occurs within cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed in lower lying areas near wetlands under Spearwood (<i>Kunzea glabrescens</i>) thickets (Western Australian Herbarium 1998-, DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Acacia benthamii</i>	-	P2	Nature Map	Shrub to 1 m tall. Flowers are yellow, visible from August to September. Habitat for this species is sand overlying limestone breakaways (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	-	P3	Nature Map	Limited habitat information available. Known from coastal areas (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Calandrinia oraria</i>	-	P3	Nature Map	Limited habitat information available. Known from coastal areas (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species
<i>Dillwynia dillwynioides</i>	-	P3	Nature Map	A decumbent or erect, slender shrub between 30-120 cm tall. Flowers are red & yellow/orange and visible from August to December. Habitat for this species occurs on sandy soils in winter-wet depressions (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Schoenus capillifolius</i>	-	P3	Nature Map	A semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Flowers are green, occurring from October to November. Habitat for this species includes brown mud and claypans (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Sphaerolobium calcicola</i>	-	P3	Nature Map	Slender multi-stemmed shrub (scandent or erect) to 1.5 m tall. Flowers are orange-red and visible in June or from September to November (Western Australian Herbarium 1998-). Habitat for this species is white-grey-brown sand over limestone or sandy clay substrate over black-peaty-sandy-clay. This species has been found to occur on tall dunes, and in low-lying areas including interdunal swamps and winter-wet flats (Western Australian Herbarium 1998-).	Does not occur	Preferred habitat does not occur
<i>Dodonaea hackettiana</i>	-	P4	Nature Map	A straight, tall shrub reaching 1-5 m in height. Has a yellow-green/red flower that generally blooms from July to October. It can be found in areas of sand and along outcropping limestone (Western Australian Herbarium 1998-)	Does not occur	Adequate survey effort did not record this species
<i>Jacksonia sericea</i>	-	P4	Nature Map	Low spreading shrub to 60 cm tall. Flowers are orange and visible December or January or February. Habitat for this species is calcareous and sandy soils (Western Australian Herbarium 1998-).	Does not occur	Adequate survey effort did not record this species

Species	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Stylidium longitubum</i>	-	P4	Nature Map	Erect annual (ephemeral), herb grows 0.05-0.12 m high. Flowers October to December. Grows in sandy clay, clay in seasonal wetlands (Western Australian Herbarium 1998-).	Highly unlikely	Preferred habitat does not occur

¹Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

CR = listed as Critically Endangered under the EPBC Act.

EN = listed as Endangered under the EPBC Act.

VU = listed as Vulnerable under the EPBC Act.

²Species listed in Western Australia under the *Wildlife Conservation Act 1950* (WC Act) or by the Department of Biodiversity, Conservation and Attractions (DBCA).

S1 = Schedule 1: Flora that are considered likely to become extinct or rare, as critically endangered flora (CR) under the WC Act.

S2 = Schedule 2: Flora that are considered likely to become extinct or rare, as endangered flora (EN) under the WC Act.

S3 = Schedule 3: Flora that are considered likely to become extinct or rare, as vulnerable flora (VU) under the WC Act.

P1 = Priority 1: Poorly-known species – species that are known from one or a few locations (generally five or less) which are potentially at risk (DBCA).

P2 = Priority 2: Poorly-known species – species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation (DBCA).

P3 = Priority 3: Poorly known species – species that are known from several locations, and the species does not appear to be under imminent threat (DBCA).

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring (DBCA).

³NatureMap = NatureMap database search (DBCA 2007-2018).

PMST = EPBC Act Protected Matters Search Tool (DotEE 2018).

Appendix D : Fauna likelihood of occurrence assessment

All marine mammals, Whales and other Cetaceans, fish and marine reptiles have not been included in this likelihood of occurrence assessment as the Site is terrestrial in nature.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris ferruginea</i>	CR	S3	NatureMap; PMST	This species is migratory. Known habitat includes intertidal mudflats in sheltered coastal areas, such as estuaries and non-tidal swamps and lakes near the coast. The species has been recorded less often inland around lakes, dams and bore drains with bare edges of mud or sand. The distribution of the species is limited by land clearing and disturbance at roost and feeding sites (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Limosa lapponica menzbieri</i>	CR	S3	PMST	This species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and salt works, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Numenius madagascariensis</i>	CR & IA	VU	PMST	This species is migratory with a primarily coastal distribution and is commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Pseudocheirus occidentalis</i>	CR	S1	PMST	This species is an arboreal species, preferring areas of Peppermint (<i>Agonis flexuosa</i>) woodlands and peppermint/tuart associations. This species generally prefers areas of higher water content, predominately inhabiting areas of the south-western corner of Western Australia (DotEE 2018c).	Potential	Preferred habitat is present.
<i>Bettongia penicillata ogilbyi</i>	EN	S1	PMST	Open forest and woodland with a low understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands. The species has been reduced to 1% of its' pre-European range and currently only exists in isolated pockets in uninhabited vegetation (DotEE 2018c).	Does not occur	Species does not occur on the Swan Coastal Plain
<i>Botaurus poiciloptilus</i>	EN	S2	PMST	Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours 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. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. <i>Phragmites</i> , <i>Cyperus</i> , <i>Eleocharis</i> , <i>Juncus</i> , <i>Typha</i> , <i>Baumea</i> , <i>Bolboschoenus</i>) or cutting grass (<i>Gahnia</i>) growing over muddy or peaty substrate (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris canutus</i>	EN & IA	V	PMST	This species is migratory. During the non-breeding season in Australasia, the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. They are occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and salt works (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calyptorhynchus baudinii</i>	EN	S2	PMST	Baudin's Cockatoo occurs in south-west Western Australia. The range of the species, which is generally bounded by the 750-mm isohyet, extends from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Kojonup. Habitat for this species mainly occurs in eucalypt forests, especially Jarrah, Marri and Karri forest. The species is less frequently in woodlands of wandoo (<i>E. wandoo</i>), blackbutt (<i>E. patens</i>), flooded gum (<i>E. rudis</i>), yate (<i>E. cornuta</i>), partly cleared farmlands and urban areas, including roadside trees and house gardens (DotEE 2018c).	Potential	On the edge of the species range
<i>Calyptorhynchus latirostris</i>	EN	S2	NatureMap; PMST	Known habitat includes remnant eucalypt woodlands, and shrubland or Kwongan heathland dominated by proteaceous species. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for agriculture. Known to utilise <i>C. calophylla</i> , * <i>C. citriodora</i> , <i>E. patens</i> , <i>E. marginata</i> , <i>X. preissii</i> and <i>A. fraseriana</i> as a foraging plant, <i>C. calophylla</i> as breeding habitat and <i>C. calophylla</i> and <i>E. marginata</i> as roosting habitat (DotEE 2018c).	Likely	Preferred habitat likely to be present.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Diomedea amsterdamensis</i>	EN & IA	CR	PMST	A predominately marine species, preferring to nest in open patchy vegetation near exposed hillocks and ridges and when it is not breeding it will sleep and rest on the ocean waters (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diomedea dabbenena</i>	EN & IA	CR	PMST	A pelagic marine species that prefers to forage in open waters, and likes to rest and sleep amongst the open water when not breeding (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Diomedea sanfordi</i>	EN & IA	S3	PMST	A marine species that prefers areas amongst the subantarctic, subtropical and Antarctic waters, preferring waters between 6-20°C. This species will generally nest on flat/gentle slopes in areas that are relatively exposed to allow for take-off and landing. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Isoodon fusciventer</i>	EN	P4	NatureMap	Scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. On the Swan Coastal Plain, Quenda are often associated with wetlands (DotEE 2018c).	Possible	Species may utilise the habitat and occurs in the area
<i>Macronectes giganteus</i>	EN & IA	P4	PMST	The Southern Giant-Petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack-ice and onto the Antarctic continent (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Myrmecobius fasciatus</i>	EN	S2	NatureMap	Can be found in areas of Acacia woodlands, as well as in areas on sand plain and sand dune that are dominate by spinifex. The species can commonly be found in the south-	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
				west of Western Australia in areas of Eucalyptus woodlands and forests (DotEE 2018c)		
<i>Rostratula australis</i>	EN	T	PMST	This species generally inhabits inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum <i>Muehlenbeckia</i> or canegrass or sometimes tea-tree (<i>Melaleuca</i>) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Anous melanops</i>	VU	S2	PMST	The Australian lesser noddy is only known to breed on the Houtman Abrolhos Islands. Birds appear to remain near the breeding islands all year. A population thought to be Australian lesser noddy possibly breeds on Ashmore Reef and may be colonising Cocos (Keeling) Island, however the subspecific identity has not been confirmed (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calyptorhynchus banksii naso</i>	VU	S3	NatureMap; PMST	Known habitat includes remnant eucalypt woodlands, especially Jarrah, Marri and Karri forest. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for development or agriculture. Known to utilise <i>Corymbia calophylla</i> , <i>*Corymbia citriodora</i> , <i>Allocasuarina fraseriana</i> , <i>Eucalyptus patens</i> and <i>Eucalyptus marginata</i> as a foraging plant and <i>C. calophylla</i> as breeding habitat (DotEE 2018c).	Potential	May potentially utilise the Reserve, however no suitable foraging species present.
<i>Charadrius leschenaultia</i>	VU & IA	V	PMST	The species is predominately a coastal species, preferring areas that are sheltered, sandy, shelly and/or muddy. As well as inshore reefs, small rocky islands and coral reefs. They are rarely spotted in shallow freshwater wetlands (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Dasyurus geoffroii</i>	VU	S3	PMST	Current habitat largely restricted to the southwest forests of WA. The species prefers to rest in hollow logs and earth burrows during the day, and will predominately forage along the ground at night. The distribution of the species is limited by land clearing and predation by feral cats and foxes (DotEE 2018c).	Unlikely	Species is unlikely to occur on the Swan Coastal Plain
<i>Diomedea epomophora</i>	VU & IA	S3	PMST	This species occurs in subantarctic, subtropical and occasionally Antarctic waters. It has been observed where the water temperature is between 6 to 20 degrees Celsius. It nests on flat, gently sloping ground on slopes, ridges, gullies and plateaux of large islands. Its nests are placed within vegetation that are sparse enough to enable easy access (DotEE 2018c)	Does not occur	Preferred habitat does not occur
<i>Diomedea exulans</i>	VU & IA	S1	PMST	This species is marine, pelagic and aerial. It has been observed where the water temperature is between -2 to 24 degrees Celsius. In the Antarctic it rarely enters the ice belt. In Australasia this species occurs inshore, offshore and in pelagic waters. On breeding islands, it nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. It prefers open or patchy vegetation and nests in areas that are near exposed ridges or hillocks so that it can take off (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Halobaena caerulea</i>	VU	-	PMST	The blue petrel previously bred on Macquarie Island itself, but breeding is now restricted to offshore stacks near Macquarie Island (Garnett & Crowley 2000). Extraliminally, the blue petrel breeds on numerous other subantarctic islands in Indian and	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
				Atlantic Oceans including Crozet, Kerguelen, Marion, Prince Edward Island and South Georgia (DotEE 2018c).		
<i>Leipoa ocellata</i>	VU	S3	PMST	This species is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as Broombush and Scrub Pine. In Western Australia, they are also found in some shrublands dominated by acacia, and occasionally in woodlands dominated by eucalypts (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Limosa lapponica baueri</i>	VU	S3	PMST	This species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and salt works, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Macronectes halli</i>	VU & IA	-	PMST	The Southern Giant-Petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack-ice and onto the Antarctic continent. The range of the Northern Giant-Petrel extends into subtropical waters mainly between winter and spring. It frequents both oceanic and inshore waters near breeding islands and in the non-breeding range (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pachyptila turtur subantarctica</i>	VU	-	PMST	This species is marine, with breeding only known from two rock stacks off Macquarie Island. Habitat for this species is predominantly marine/coastal (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Phoebastria fusca</i>	VU	S2	PMST	The Sooty Albatross is a rare, but probably regular migrant to Australia, mostly in the autumn-winter months, occurring north to south-east Queensland, NSW, Victoria, Tasmania and South Australia (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pterodroma mollis</i>	VU	-	PMST	The Soft-plumaged Petrel is generally found over temperate and subantarctic waters in the South Atlantic, southern Indian and western South Pacific Oceans. The species is a regular and quite common visitor to southern Australian seas. The birds breed on islands off Tasmania, in the New Zealand region and in the Indian and South Atlantic Oceans and burrow among tussock grass and ferns on slopes and valleys (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Setonix brachyurus</i>	VU	S3	NatureMap	This species is a habitat specialist depending on its location whether that be on the mainland or restricted to its island population. On the mainland, the species prefers areas of complex vegetation structure of low, dense vegetation that provides protection from predation. The species prefers areas with high water availability year-round, preferring areas near riparian and swamp habitat (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Sternula nereis</i>	VU	S3	PMST	This species nests on sandy beaches, spits and banks above the high tide line and below vegetation and roosts on beach at night. It is also found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche carteri</i>	VU	S2	PMST	The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean where it is particularly abundant off Western Australia. In the Australasian region, the species occupies inshore and offshore waters and nests on tussock-covered coastal cliffs and slopes, often in rocky situations (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche cauta</i>	VU & IA	S3	PMST	The Shy Albatross is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current Off South America. The Shy Albatross preference for sea-surface temperatures is poorly known. In the southern Indian Ocean, the species has been observed over waters of 6.4-13.5°C (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche cauta steadi</i>	VU & IA	S3	PMST	This species is a marine bird that prefer waters found in the subantarctic and subtropical waters. The species can be observed in waters with a temperature ranging from 6.4°C-13.5°C. The White-capped Albatross is seen to nest on slopes with vegetation consisting of tussock and succulents (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Thalassarche impavida</i>	VU & IA	S3	PMST	The Campbell Albatross visits Australia in its non-breeding season where they are known to forage over the oceanic continental shelf preferring sub-Antarctic and subtropical waters. They can tolerate sea temperatures between 0-24°C (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Thalassarche melanophris</i>	VU & IA	S2	PMST	This Albatross species inhabits Antarctic, subantarctic and temperate waters and is tolerant to a wide range of sea temperatures (0-24°C). The species is said to forage around the breaks of continental and island shelves and across nearby water banks (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Westralunio carteri</i>	VU	S3	NatureMap PMST	Species inhabits freshwater waterbodies.	Does not occur	Preferred habitat does not occur
<i>Actitis hypoleucos</i>	IA	-	NatureMap	This species is a migratory species. During the non-breeding season, the population migrates from the Russian far east. The Common Sandpiper mainly inhabit wetlands, predominately coastal but occasionally inland as well. This species is commonly found in areas of muddy margins or rocky shores where they forage with the protection of obstacles from varying substrates (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris acuminata</i>	IA	-	NatureMap	Habitat for this species is muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in salt works and sewage farms and use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calidris melanotos</i>	IA	-	NatureMap	This is a migratory species. Known habitat includes shallow wetlands either fresh or saline usually in coastal/near coastal habitats but can be found further inland. Prefers areas with low, emergent or fringing vegetation with open fringing mud flats. During the non-breeding season, the species occurs mainly the Eastern part of Australia, rarely being sighted in Western Australia (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Calidris ruficollis</i>	IA	-	NatureMap	A migratory species that is found predominately in coastal areas such as sheltered inlets, bays, lagoons and estuaries. Occasionally they can be found on stony/rocky shores, reefs and flooded paddocks. They will usually feed in areas of intertidal mudflats or sandflats and generally in very shallow waters (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Calidris subminuta</i>	IA	-	NatureMap	This species is typically found along the coast when present in Western Australia. It is predominately a terrestrial wetland species, preferring shallow freshwater/brackish wetlands. Has preference to areas of low vegetation such as rushes, sedges, samphire and short grasses (DotEE 2018b).	Does not occur	Preferred habitat does not occur
<i>Charadrius dubius</i>	IA	-	NatureMap	Is a vagrant species within Australia with an extremely large range. Prefers areas of sand banks, the shores of rivers, lakes, residual flood waters and areas of short grass. It is not likely for this species to inhabit coastal areas as it prefers lowland habitats (IUCN 2018).	Does not occur	Preferred habitat does not occur
<i>Chlidonias leucopterus</i>	IA	-	NatureMap	This species spends most of its time in Australia during its non-breeding season where it prefers coastal habitats. Within Western Australia the species can be found from Ballingup through to the Pilbara and Kimberley Regions, only venturing inland along major river systems (e.g. The Ord) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Gelochelidon nilotica</i>	IA	-	NatureMap	Preferring bare and sparsely vegetated islands, flats, dry mud and sand. This species can also be found amongst dune areas, saltmarshes, salt pans, rivers, marshes and swamps (DotEE 2018c)	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Limosa limosa</i>	IA	-	NatureMap	The Black-tailed Godwit is found to prefer coastal habitats within sheltered bays, estuaries and lagoons with intertidal mudflats and sandflats. The generally prefer areas with sparse vegetation such as salt marshes and salt flats. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pandion cristatus</i>	IA	-	NatureMap	The Osprey can be found in littoral and coastal habitats, as well as in terrestrial wetlands in tropical and temperature climate. They generally prefer coastal areas although can be seen to travel inland along major rivers (this normally occurs in northern Australia) (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Phaethon rubricauda</i>	IA	P4	NatureMap	A migratory, marine species that generally occurs along the coast, breeding in cliffs and under bushes within the tropical climate of Australia (DotEE 2018c)	Does not occur	Preferred habitat does not occur
<i>Plegadis falcinellus</i>	IA	-	NatureMap	A migratory marine bird that prefers fresh water marshes that can be found along the edges of lakes, rivers, lagoons, flood-plains, sewage ponds and cultivated areas under irrigation. The species can also be found along coastal habitats such as estuaries, saltmarshes and coastal lagoons. (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Pluvialis fulva</i>	IA	-	NatureMap	This species generally occurs along the coastal areas of Australia, and occasionally amongst inland wetlands. They usually prefer areas long beaches and mudflats, as well as sand flats and sheltered areas such as harbours and estuaries. The tend not to inhabit terrestrial habitats, where sightings of this species are less common (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Pluvialis squatarola</i>	IA	-	NatureMap	Occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Tringa glareola</i>	IA	-	NatureMap	Uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. They are also found at some small wetlands only when they are drying (DotEE 2018c	Does not occur	Preferred habitat does not occur
<i>Tringa nebularia</i>	IA	-	NatureMap	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayment's, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and salt flats DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Tringa stagnatilis</i>	IA	-	NatureMap	This species is commonly found along coastal and inland wetlands within Australia. Within Western Australia records are scattered and are mainly found along the coast. They prefer permanent or ephemeral wetlands with varying salinity	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
				levels such as swamps, salt pans, saltmarshes, intertidal mudflats and estuaries (DotEE 2018c).		
<i>Xenus cinereus</i>	IA	-	NatureMap	The Terek Sandpiper generally forages in open, soft wet intertidal mudflats or within sheltered estuaries, harbours or embayments. They are rarely viewed near the edge of water, and may be found to roost amongst mangroves and perch in branches (DotEE 2018c).	Does not occur	Preferred habitat does not occur
<i>Falco peregrinus</i>	-	S	NatureMap	This species is able to tolerate a wide range of habitats, inhabiting both hot and cold climates, along with wet and dry areas. Nesting generally occurs amongst depressions in rock faces without nests (IUCN 2018)	Unlikely	Preferred habitat does not occur
<i>Falsistrellus mackenziei</i>	-	P4	NatureMap	Forests subject to high levels of rainfall that are generally dominated by tall trees such as Jarrah, Marri, Karri and Tuart, but has also been found within Banksia woodlands along the Swan Coastal Plain (IUCN 2018).	Does not occur	Preferred habitat does not occur
<i>Hydromys chrysogaster</i>	-	P4	NatureMap	Permanent fresh or brackish water, although it can also be found in marine environments, including coastal mangroves. The species occupies a wide variety of freshwater habitats, from subalpine streams and other inland waterways to lakes, swamps, and farm dams. Populations may be abundant in drainage swamps.	Does not occur	Preferred habitat does not occur
<i>Ixobrychus dubius</i>	-	P4	NatureMap	This species prefers areas consisting of reedbeds, dense freshwater swamps and well-fringed watercourses (DotEE 2018c).	Does not occur	Preferred habitat does not occur

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Notamacropus eugenii subsp. derbianus</i>	-	P4	NatureMap	Species habitat information unavailable.	Does not occur	Species has a restricted distribution on the WA mainland
<i>Notamacropus irma</i>	-	P4	NatureMap	The Western Brush Wallaby prefers areas of open forest or woodlands that are seasonally wet and have low vegetation. They prefer dry, sclerophyll forests such as mallee and jarrah, as well as heathland scrub (DotEE 2018c)	Does not occur	Species was not recorded with the study area not able to support this species
<i>Oxyura australis</i>	-	P4	NatureMap	Can be found in areas of deep, permanent wetlands and swamps with dense aquatic vegetation and predominately lives in the water, only leaving if disturbed or to move for breeding (NSW OEH 2018).	Does not occur	Preferred habitat does not occur
<i>Synemon gratiosa</i>	-	P4	NatureMap	This species is associated with a preferred host plant, the <i>Lomandra maritima</i> . This is especially evident in two habitats: 1. Coastal heathland on Quindalup dunes where it is restricted to the secondary dunes 2. Banksia woodland on Spearwood and Bassendean dunes. "(DotEE 2018c)	Potential	Preferred habitat is present.

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Thinornis rubricollis</i>	-	P4	NatureMap	The hooded plover (western) inhabits ocean beaches and the edges of near-coastal and inland salt-lakes that may be hundreds of kilometres from the coast. It occasionally occurs inland from the edges of lakes, on nearby grassy freshwater seepages, and in estuaries. It appears nomadic, forming flocks of hundreds on inland lakes in the early breeding season and forming very large non-breeding flocks near coastal salt-lakes (Marchant & Higgins 1990).	Does not occur	Preferred habitat does not occur
<i>Throscodectes xiphos</i>	-	P1	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available
<i>Lerista lineata</i>	-	P3	NatureMap	This species prefers areas of sandy coastal heath and low scrubland, as well as banksia woodland, tuart open woodland with deep sands and coastal dunes (although it is most dependent on substrate type rather than vegetation type) (DotEE 2018c)	Potential	Preferred habitat is present.
<i>Neelaps calonotos</i>	-	P3	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available

Species Name	Conservation code		Source ³	Preferred habitat	Likelihood of occurrence	Justification for likelihood rating
	EPBC Ranking ¹	WA Ranking ²				
<i>Tyto novaehollandiae</i> <i>subsp. novaehollandiae</i>	-	P3	NatureMap	Species habitat information unavailable.	Potential	Limited habitat information available
<i>Calyptrorhynchus</i> sp. (white tailed black cockatoo)	-	T	NatureMap	The details of this <i>Calyptrorhynchus</i> sp. can be found in the above descriptions of <i>Calyptrorhynchus</i> species within this table.	N/A – refer to species specific assessments above.	

¹Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

CR = listed as Critically Endangered under the EPBC Act.

EN = listed as Endangered under the EPBC Act.

VU = listed as Vulnerable under the EPBC Act.

²Species listed in Western Australia under the *Wildlife Conservation Act 1950* (WC Act) or by the Department of Biodiversity, Conservation and Attractions (DBCA).

S1 = Schedule 1: Fauna that is rare or likely to become extinct as critically endangered fauna (CR) under the WC Act.

S2 = Schedule 2: Fauna that is rare or likely to become extinct as endangered fauna (EN) under the WC Act.

S3 = Schedule 3: Fauna that is rare or likely to become extinct as vulnerable fauna (VU) under the WC Act.

S7 = Schedule 7: Other specially protected fauna (OS) under the WC Act.

P2 = Priority 2: Poorly-known species – species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation (DBCA).

P3 = Priority 3: Poorly known species – species that are known from several locations, and the species does not appear to be under imminent threat (DBCA).

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring (DBCA).

³NatureMap = NatureMap database search (DBCA 2007-2018).

PMST = EPBC Act Protected Matters Search Tool (DotEE 2018).



HEAD OFFICE

Suite 2, Level 3
668-672 Old Princes Highway
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

CANBERRA

Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 9542 5622

COFFS HARBOUR

22 Ray McCarthy Drive
Coffs Harbour NSW 2450
T 02 6651 5484
F 02 6651 6890

PERTH

Level 1, Bishop's See
235 St Georges Terrace
Perth WA 6000
T 08 9227 1070
F 02 9542 5622

MELBOURNE

Level 1, 436 Johnston St
Abbotsford, VIC 3076
T 1300 646 131
F 02 9542 5622

SYDNEY

Suite 1, Level 1
101 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9542 5622

NEWCASTLE

Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 9542 5622

ARMIDALE

92 Taylor Street
Armidale NSW 2350
T 02 8081 2685
F 02 9542 5622

WOLLONGONG

Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 9542 5622

BRISBANE

Level 5, 12 Creek Street
Brisbane QLD 4000
T 07 3503 7192
F 02 9542 5622

HUSKISSON

Unit 1, 51 Owen Street
Huskisson NSW 2540
T 02 4201 2264
F 02 9542 5622

NAROOMA

5/20 Cauty Street
Narooma NSW 2546
T 02 4302 1266
F 02 9542 5622

MUDGEES

Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1234
F 02 6372 9230

ADELAIDE

2, 70 Pirie Street
Adelaide SA 5000
T 08 8470 6650
F 02 9542 5622

1300 646 131

www.ecoaus.com.au