Capel Dry Plant Remediation

Native Vegetation Clearing Permit Application (Area Permit)

Iluka ref: [0058-1624046663-62]

Revision: 0

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Contact:
Angela Bishop
Manager Environmental Regulations
angela.bishop@iluka.com

Document control

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1 Introduction

1.1 Background

Iluka Resources (Iluka) operates the Capel Dry Plant (CDP) located within the town of Capel, approximately 200 km south of Perth, Western Australia (Figure 1). The CDP commenced operation in the mid-1950s to separate and concentrate locally mined mineral sands.

Iluka proposes to perform remediation works at the CDP as part of its progressive commitment to obligations under the *Contaminated Sites Act 2003* (CS Act). This remediation work is part of a wider remediation project known as the South Capel Remediation Project (SCRP). The CDP component entails the removal of process by-products located within the soil and contributing to groundwater contamination, as well as the importation of material to backfill the excavated areas.

Removal of the by-products requires the clearing of regrowth and planted vegetation that is growing in the by-products or within soil overlying the by-products. As the clearing area is already highly disturbed with high weed infestation and the purpose of clearing is for remediation, it is unlikely soil from cleared areas will be retained for use in backfilling and rehabilitation. All surface soil stripped or excavated during clearing will be removed from site, unless it can be demonstrated to be free from contamination and suitable for rehabilitation of the areas following remediation.

The rehabilitation of cleared and excavated areas will be as follows:

1 Backfill voids with certified clean fill (DWER 2018) sourced from a soil supplier;

2 Shape and contour to a stable landform; and

3 Revegetate to pasture.

Revegetation with pasture is consistent with the original land-use (agriculture) and current zoning (Special Use: Mineral Sands Processing, Offices and ancillary uses) and that the CDP is still operational (i.e. remediation works of current operations are not planned for several years).

1.2 Purpose

This document supports a Native Vegetation Clearing Permit application under Part V of the *Environmental Protection Act 1986* (EP Act) to clear 1.34 ha of regrowth and planted native vegetation in order to access and remediate stored by-products at the CDP. This clearing is necessary to comply with remediation required under the CS Act.

The application for a Clearing (Area) Permit is made in accordance with the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The flora and fauna assessment reports supporting this application are attached in Appendix A and B. As these surveys commenced prior to 30 April 2018, they are not required to provide data packages in accordance with the Index of Biodiversity Surveys for Assessments (IBSA).

The clearing required to remediate the by-product areas (clearing permit area) is shown in Figure 2.

1.3 Regulatory framework

1.3.1 *Environmental Protection Act 1986* Part IV

The CDP was constructed and commissioned in the 1950s, prior to the enactment of the EP Act. There was no Part IV EP Act approval process associated with the construction of the plant. Consequently, there is no Part IV EP Act instrument in place.

Consultation with the OEPA on this SCRP is planned for May 2018.

1.3.2 *Environmental Protection Act 1986* Part V

Works approvals and licences were first issued under Part V of the EP Act in 1991. This site is currently operating under Licence L6194/1989/14 (Category 8 – Mineral sands mining or processing).

Based on consultation with Department of Water and Environmental Regulation (DWER) Licencing Branch, no amendment to this licence is required for the proposed activities (D Hartnup - email dated 16 February 2018).

1.3.3 *Mining Act 1978*

The CDP is not located on *Mining Act 1978* (Mining Act) tenure and, therefore, is not regulated under the Mining Act.

1.3.4 *Contaminated Sites Act 2003*

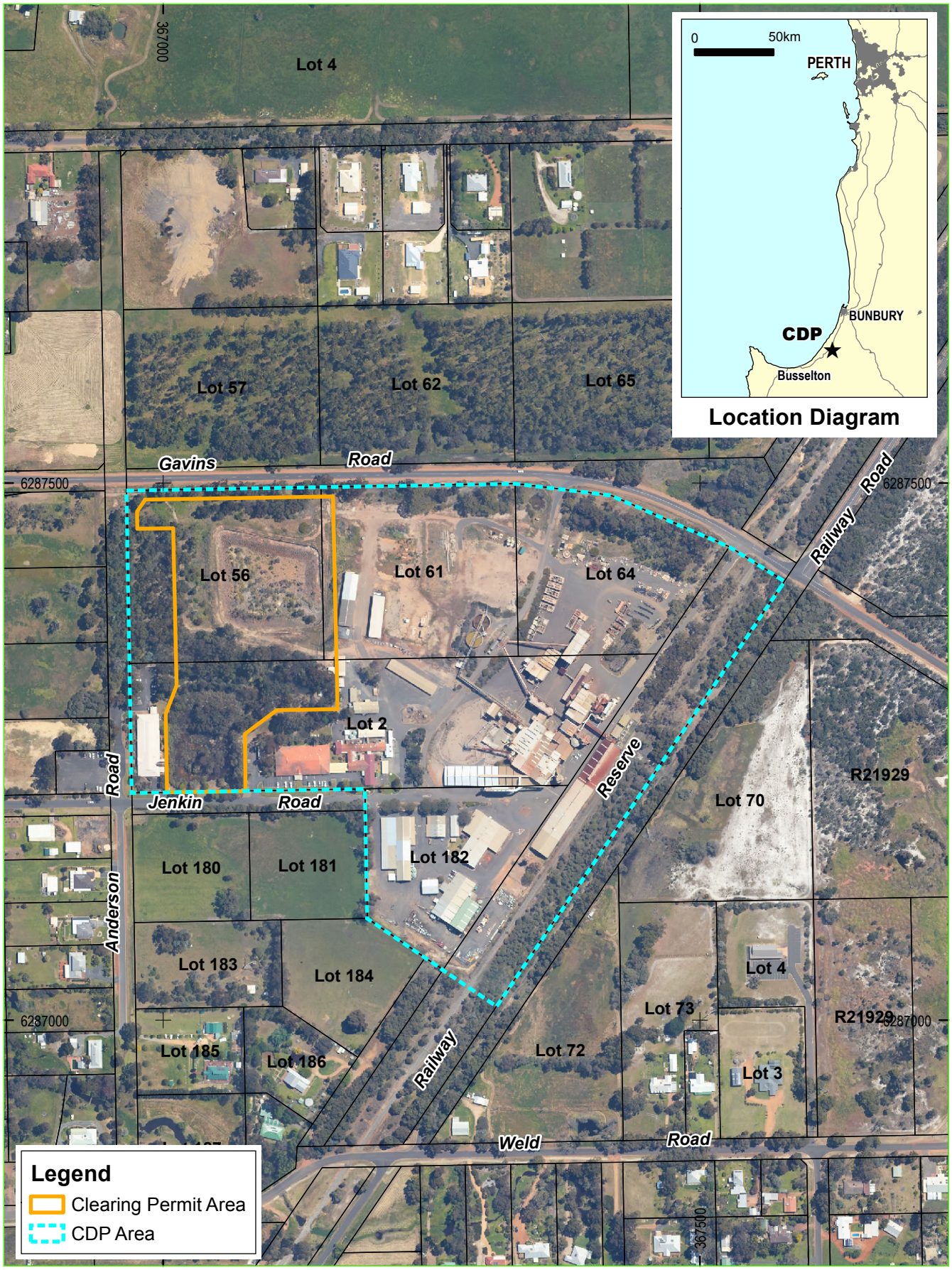
In 2007, Iluka reported the CDP as a "known" contaminated site in accordance with the CS Act. The DWER Contaminated Sites Branch subsequently declared the CDP to be a "source site" and classified it as "contaminated – remediation required." To remediate this stage of the CDP, Iluka will clear 1.34 ha of native regrowth and planted vegetation to allow for access to and removal of by-products. All remediation activities to which this permit application pertains will be managed under a Remediation Action Plan (RAP), approved under the CS Act.

1.3.5 *Environment Protection and Biodiversity Conservation Act 1999*

A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) will be submitted to the Department of the Environment and Energy (DEE) regarding potential impacts to Threatened Fauna species.

1.3.6 Shire of Capel

The site is zoned Special Use area (for mineral sands processing, offices and ancillary uses) under Capel Town Planning Scheme 7. Therefore, no change to planning approvals is required. Consultation with the Shire is ongoing with regards to this project.



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Aerial Photograph: November 2016

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MGA Coordinates, GDA94

CAPEL DRY PLANT

LOCATION

ILUKA

ORIG: K.Tedesco DRAWN: D.G.S. SCALE: 1:5,000 (A4) DATE: May 2018 DWG No: 247662 ver.00

FIGURE: 1

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Aerial Photograph: Nov.2016

CAPEL DRY PLANT

CLEARING PERMIT AREA

ILUKA

ORIG: K.Tedesco DRAWN: D.G.S. SCALE: 1:1,500 (A4) DATE: May 2018 DWG No: 247663 ver.00

FIGURE: 2

2 Proposed clearing

2.1 Clearing area

The CDP is located in the northern part of the town of Capel on Jenkin Road (Figure 2). This area was historically agricultural (pasture) land which was then converted to hardstand for processing and trees planted for visual screening. The vegetation in the area is, therefore, planted species with some regrowth. Iluka considers that vegetation is neither remnant vegetation nor rehabilitation as any regrowth / recruitment is from planted species.

Clearing will be undertaken on Lot 2 on Diagram 90768, Lot 56 on Plan 222236 and Lot 61 on Plan 222236 (Figure 2). The total disturbance area is approximately 3.64 ha with a clearing footprint within this area of approximately 1.34 ha is degraded and 2.30 ha is completely degraded.

2.2 Clearing works

Clearing will be undertaken in Q3/Q4 2018 with the project completed by Q1 2019, subject to all approvals being obtained for the project and operational considerations. Clearing will be carried out to facilitate:

- excavation of by-products; and
- access for heavy machinery and trucks to the by-products.

Preparatory vegetation clearing and general works will be performed by the Remediation Contractor in accordance with approvals. The area of vegetation clearing is to be minimised wherever possible so, prior to clearing, no-go areas and working areas will be defined / delineated and will be communicated to all site personnel undertaking the clearing activities. Any clearing to be undertaken shall be appropriately demarcated and demarcation (survey flagging tape, etc.) that identifies clearing boundaries will be unique to this activity and not easily confused with other markers used on-site.

Vegetation cross-contaminated with process by-product will be stockpiled by the Remediation Contractor at an area on-site designated by Iluka for drying and burning. Once adequately dry, burnt material will be disposed of to the Hutton Road Containment Facility extension as with the process by-product.

Representative photos of the areas to be cleared are presented in Plate 1 and Plate 2.

Plate 1 Example of vegetation type to be remediated – by-product area

Plate 2 Example of area to be remediated – vegetation in artificial lake

3 Assessment against the Ten Clearing Principles

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

The native vegetation at CDP is not remnant, having all been cleared for agriculture prior to development of the site. The existing vegetation has all been planted and / or has been recolonised from planted species or nearby vegetation.

Ecoedge (2015) carried out a Level 1 vegetation and flora survey of the CDP (Appendix A).

Two vegetation units occur within the Area Permit area (Ecoedge 2015; Figure 3):

1. Cc/Er_pasture; *Corymbia calophylla* or *Eucalyptus rudis* over pasture or weeds: *Corymbia calophylla* or occasionally *Eucalyptus rudis* over mainly exotic grasses including **Avena fatua*, **Ehrharta longiflora*, **E. calycina*, **Eragrostis curvula* on red-brown loam.

   This vegetation unit is classified Completely Degraded (Figure 4) according to Keighery (1994).

2. Planted; exotic eucalypts and other amenity species.

   This vegetation unit is not representative of any naturally occurring vegetation assemblage and, as such, its condition was not assessed. Similarly, it is not representative of either the Guildford or Swan Vegetation Complexes (Ecoedge 2015).

Table 1 shows the proposed amount of clearing within the vegetation units on site.

Table 1 Clearing of vegetation units within the Area Permit area

Reference Code	Description	Condition	Area within clearing footprint (ha)
Cc/Er_ pasture	*Corymbia calophylla* or *Eucalyptus rudis* over pasture or weeds.	Completely Degraded	0.45
Planted	Planted exotic eucalypts and other amenity species.	N/A	0.89
Other[1]	Infrastructure, dirt roads and bare ground occurring within the clearing permit area, some of which includes recolonised vegetation (grassland with scattered trees).	N/A	2.30
Total			**3.64**

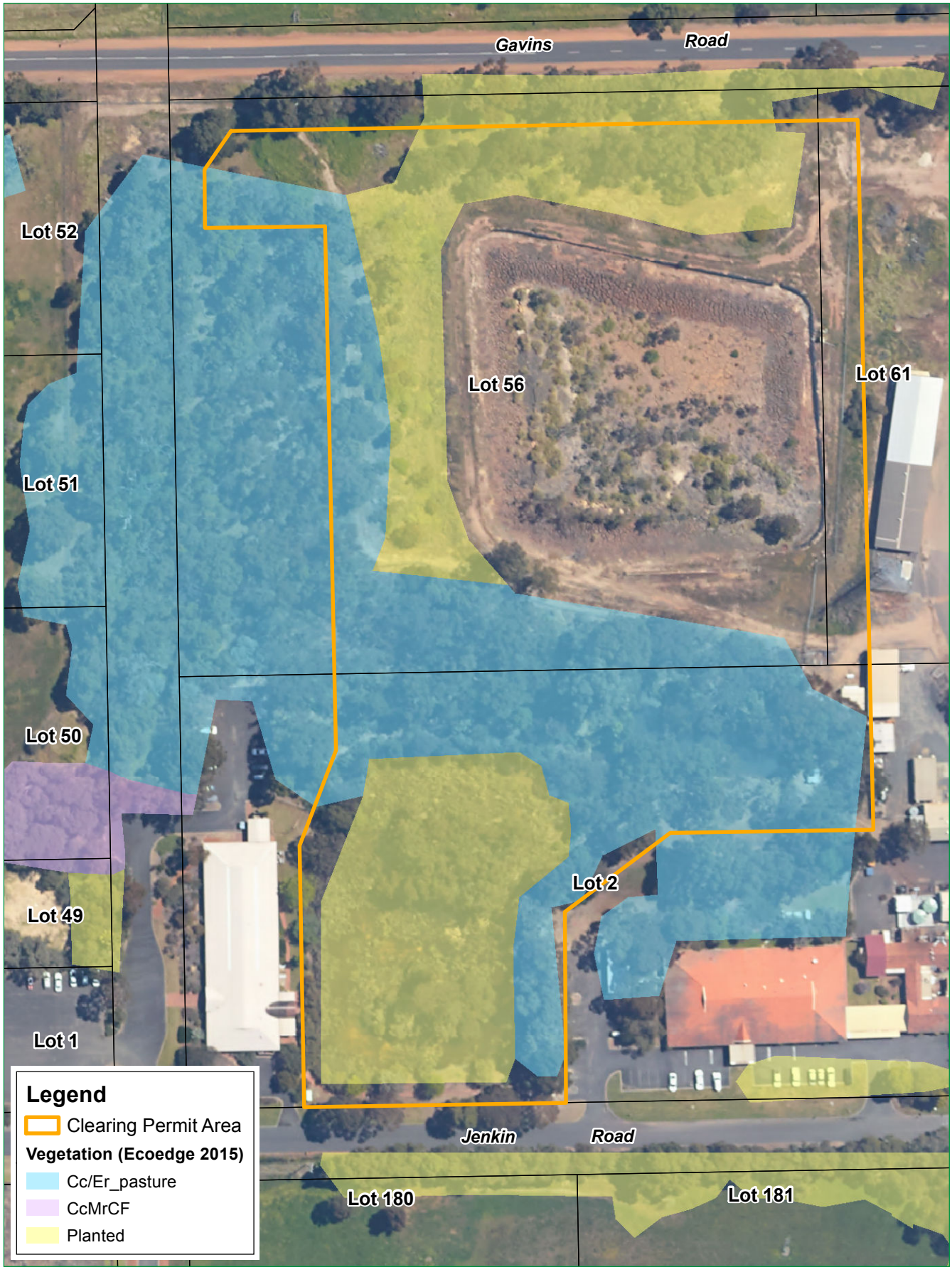
1 The by-product dam and other infrastructure areas include vegetation that has colonised from surrounding areas

These vegetation units are not representative of the pre-European Guildford and Swan vegetation complexes that were mapped for the area (Ecoedge 2015).

As a result of the site's high degree of historical disturbance and limited connectivity to other areas of bushland, biodiversity has been significantly reduced from its original levels.

Therefore, the proposed clearing is not expected to have a significant impact on biodiversity.

The proposed clearing is not at variance with this principle.



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Aerial Photograph: Nov.2016

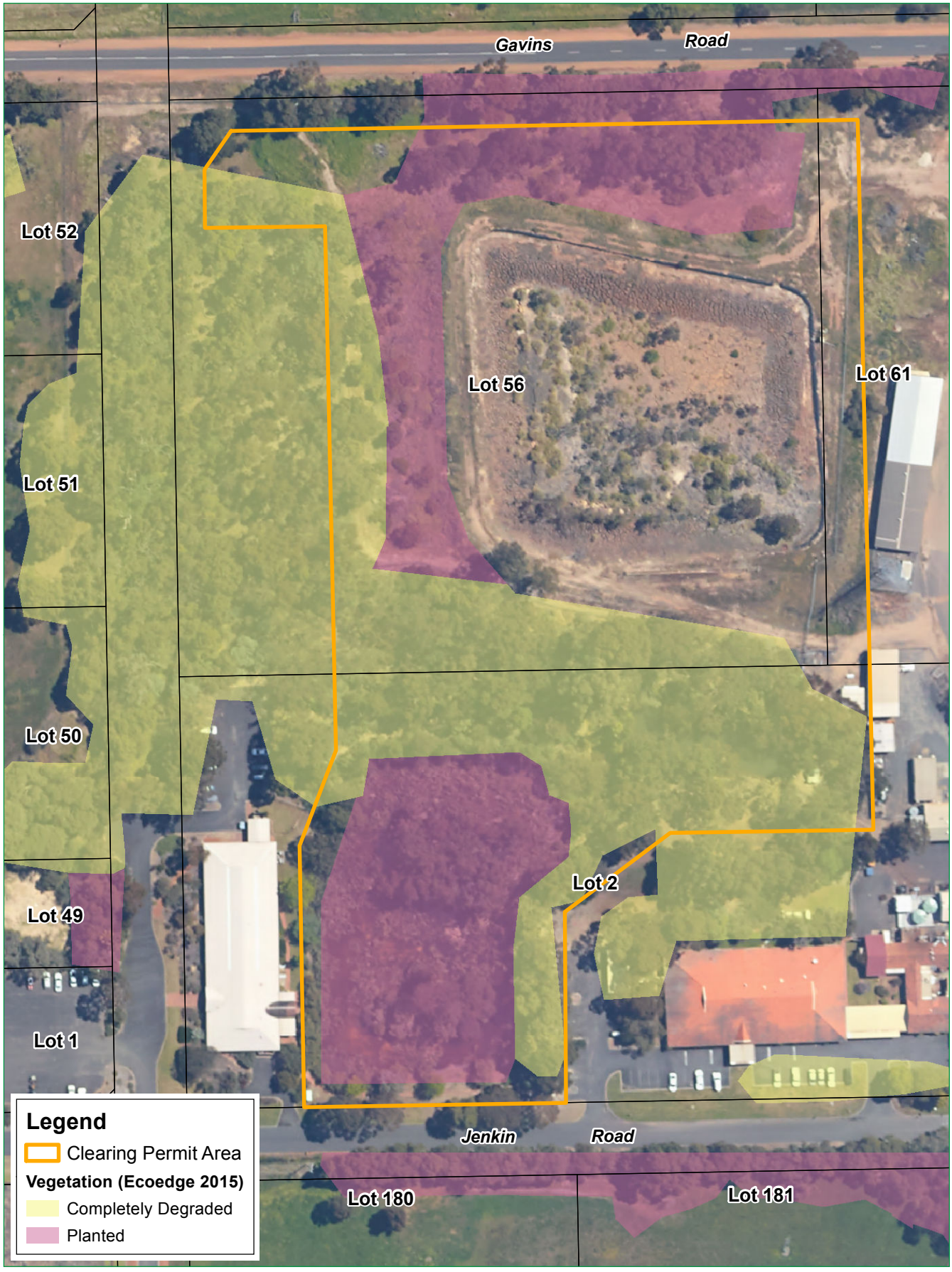
CAPEL DRY PLANT

VEGETATION UNITS

ILUKA

ORIG: K.Tedesco DRAWN: D.G.S. SCALE: 1:1,500 (A4) DATE: May 2018 DWG No: 247664 ver.00

FIGURE: 3



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Aerial Photograph: Nov.2016

CAPEL DRY PLANT

VEGETATION CONDITION

ILUKA

ORIG: K.Tedesco DRAWN: D.G.S. SCALE: 1:1,500 (A4) DATE: May 2018 DWG No: 247665 ver.00

FIGURE: 4

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

3.2.1 Fauna habitat

The CDP is located in the western section of the southern Swan Coastal Plain Bioregion (SWA) classified as part of the Interim Biogeographic Regionalisation for Australia (IBRA). The CDP is within a further defined subregion of the SWA referred to as the 'Swan Coastal Plain subregion' or the 'Perth subregion' (SWA2).

Harewood (2018) conducted a Level 1 survey of the fauna and habitat values of the vegetation at CDP and found that the site was highly degraded, containing a minimal amount of native vegetation, including:

- The by-product dam has some limited regrowth in a central high point and is bordered by a grassland of introduced species, with highly degraded open woodland of marri to the west, and flooded gum and planted non-endemic eucalyptus to the north (Figure 5);
- The artificial lake has some open water and is covered with a dense *Typha orientalis* reed bed which extends to the fire dam; and
- The artificial lake and the fire dam are bordered by planted endemic and non-endemic eucalyptus trees and shrubs with some marri, flooded gum, peppermint (*Agonis flexuosa*), tuart (*Eucalyptus gomphocephala*) and paperbark (*Melaleuca* sp.) also being present (Figure 5).

Overall, the fauna habitat quality is poor as a result of the site's high degree of historical disturbance (Harewood 2018). Connectivity to other areas of bushland is also very limited with the patchy, degraded bushland along the southern side of Gavin's Road providing a tenuous linkage to vegetation within the railway reserve to the east (as can be seen in Figure 2) (Harewood 2018). These factors, coupled with relatively small size of the subject site, suggest that the biodiversity has been significantly reduced from its original levels with only a fraction of the original fauna assemblage likely to occur (Harewood 2018).

The desktop review by Harewood (2018) indicated that 121 fauna species are listed as potentially occurring in the area, with only six of these being conservation-significant fauna species. Most of the species were considered unlikely to use the area due to a lack of suitable habitat. Opportunistic fauna observations showed a total of 24 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the day and night time surveys.

The Level 1 reconnaissance survey confirmed that three Threatened fauna species listed under State and/or Commonwealth legislation were active in the area, comprising:

- Black cockatoos:
    - Forest Red-tailed Black Cockatoo (*Calytorhynchus banksii naso*)
    - Baudin's Black Cockatoo (*Calytorhynchus baudinii*)
- Western Ringtail Possum (*Pseudocheirus occidentalis).*

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0 25 50 m

Aerial Photograph: Nov.2016

CAPEL DRY PLANT

WRP AND BC FORAGING HABITAT TO BE CLEARED

ILUKA

ORIG: K.Tedesco DRAWN: D.G.S. SCALE: 1:2,000 (A4) DATE: May 2018 DWG No: 247666 ver.00

FIGURE: 5

3.2.2 Black Cockatoos

The fauna survey (Harewood 2018) included an assessment of the project area's ability to support breeding, foraging or roosting habitat for black cockatoos.

Foraging evidence was observed at the site in the form of chewed marri fruits from Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo. Marri, flooded gum, tuart and bottlebrush (*Callistemon* sp.), recorded at CDP, are known to be used as a direct food source (i.e. fruits or flowers) by one or more species of black cockatoo. However, flooded gum, tuart and bottlebrush, while species documented as being fed upon, would not represent a significant proportion of any one birds' diet as these plant species are a high effort, low yield food source. Marri is only represented by a small portion of the vegetation present within the clearing permit area with only a few individuals (i.e. < 0.5 ha comprising six trees).

Overall, the area is not regarded as representing quality foraging habitat for black cockatoos because of the general absence of favoured foraging species (Harewood 2018).

There is approximately 8,195 ha of native vegetation within 12 km of CDP (Figure 5 in Attachment B Fauna Assessment Capel Dry Plant) which is very likely to represent potential black cockatoo foraging habitat of some type, as well as up to 445 ha of pine plantation within this extent, which is suspected to be used as foraging for Baudin's Black Cockatoo (Harewood 2018).

Within the project area, six trees were marri (within an area of < 0.5 ha of "marri open woodland") and nine were tuart, with 10 unidentified non-endemic eucalypt trees represented by at least two, presumed eastern states, species; it is not confirmed that these tree species have the propensity to develop hollows suitable for black cockatoos. The assessment identified 25 trees with a Diameter at Breast Height (DBH) of > 50 cm present within the remediation area (Figure 5). None of the trees appeared to contain hollows of any size.

A significant portion of the 8,195 ha of native vegetation within 12 km of CDP is vegetation located within the Tuart Forest National Park (total area 3,030 ha) and the Capel Nature Reserve (94 ha). Therefore, there is significant potential for breeding to take place in the wider area. The removal of the habitat trees at CDP (< 0.5 ha) is not expected to have an impact on breeding habitat availability into the future (Harewood 2018).

No existing roosting trees were positively identified during the survey (Harewood 2018), which included a single dusk survey.

3.2.3 Western Ringtail Possum

Nine Western Ringtail Possum (WRP) dreys were observed during the day survey within the proposed remediation area. Ten WRPs were recorded within the site and surrounds (i.e. adjacent to the CDP Administration building) during the nocturnal surveys. Four common brushtail possums were also observed during the nocturnal surveys.

The vegetation to be cleared within the project area is approximately 1.34 ha. This vegetation represents WRP habitat of some type (i.e. refuge, foraging or dispersal). The area surrounding the artificial lake is approximately 0.9 ha and offers the best quality for WRP as it is characterised by a coherent canopy structure, it provides good drey building opportunities and it contains the widest variety of potential food sources (Harewood 2018).

Similar to the black cockatoos, the vegetation in the wider area could be expected to support WRP habitat. It is unlikely the removal of the small area of habitat would result in an overall decrease in population numbers given the presence of significant areas of habitat in the vicinity known to also be in use by WRPs (Harewood 2018).

Although Harewood (2018) concluded that the vegetation to be cleared was only tenuously linked to the railway reserve to the east, a belt of trees along the western and northern edges of the remediation area will be not be cleared to enable continuation of that linkage.

Iluka proposes to relocate the WRPs (estimated to be approximately 10 individuals) from the remediation area and the area to the west of the remediation area to a nearby rail and road

reserve. Harewood (2010) conducted a Level 1 survey of the fauna and habitat values of native vegetation in the rail and road reserves located to the east of the CDP. This rail and road reserve contains habitat for Threatened Fauna species such as black cockatoo species and WRPs, and is actively used by Threatened Fauna species. It also has value as an ecological linkage / wildlife corridor.

3.2.4 Other fauna species of conservation significance

Several other species of conservation significance may use the subject site for some purpose at times although no evidence of any was found at the time of the survey.

These species are:

- Carnaby's cockatoo (*Calyptorhynchus latirostris*) – Endangered (*Wildlife Conservation Act 1950* (WC Act)), Endangered (EPBC Act)

  Listed as a potential species based on available information; no evidence of this species using the subject site was observed, but it is known to frequent the general area and so may occur at least occasionally. A small amount of the vegetation (i.e. < 0.5 ha of marri woodland) within the subject site represents quality foraging habitat. Twenty five larger trees (> 50 cm DBH) can be considered potential breeding habitat, but none contain hollows of any size. Ten of these trees appeared to be non-endemic eucalypt trees represented by at least two, presumed eastern states, species. It is not known if these tree species have the propensity to develop hollows suitable for black cockatoos. Trees within the subject site do not appear to be used for roosting.

- Peregrine falcon (*Falco peregrinus*) – Schedule 7 (WC Act)

  Listed as a potential species based on available information. This species potentially utilises some sections of the subject site as part of a much larger home range though it is only likely to occur very infrequently. There are no suitable nest sites present.

- Quenda (*Isoodon fusciventer*) – Priority 4

  Listed as a potential species based on available information. No conclusive evidence of this species being present was found during the site survey, but it may occur where ever dense ground cover exists particularly in areas surrounding the artificial lake and the fire dam.

3.2.5 Clearing controls

The following clearing controls will be in place to prevent unplanned, excessive or unapproved clearing, and to minimise impacts to fauna:

- Clearing will be undertaken during daylight hours;
- Clearing will be authorised by Iluka via a Ground Disturbance Permit, and will ensure clearing is undertaken in accordance with regulatory approvals;
- Adopting, where possible, a clearing pattern that encourages the movement of fauna to adjacent habitats; and
- A suitably qualified 'fauna spotter' will be on-site when clearing is being undertaken for the entirety of the vegetation clearing. This fauna spotter will inspect trees immediately prior to clearing and allow fauna the opportunity to evacuate (i.e. if within a tree being felled). Anyone who is to handle fauna during clearing will hold a current Regulation 15 (fauna relocation and / or education) or a Regulation 17 (scientific / study) license under the WC Act (or similar Regulation under the *Biodiversity Conservation Act 2016*, whichever is in use).

3.2.6 Summary

The survey found that the site was highly degraded, containing a minimal amount of native vegetation. The by-product dam has some limited regrowth in a central high point and is bordered

by a grassland of introduced species, with highly degraded open woodland of marri to the west, and flooded gum and planted non-endemic eucalyptus to the north. The artificial lake has some open water and is covered with a dense *Typha orientalis* reed bed which extends to the fire dam. The artificial lake and the fire dam are bordered by planted endemic and non-endemic eucalyptus trees and shrubs with some marri, flooded gum, peppermint (*Agonis flexuosa*), tuart (*Eucalyptus gomphocephala*) and paperbark (*Melaleuca* sp.) also being present.

Overall, fauna habitat quality is poor as a result of the site's high degree of historical disturbance with only a fraction of the original fauna assemblage likely to occur. Connectivity to other areas of bushland is also very limited with the patchy, degraded bushland along Gavin's Road providing a tenuous linkage to vegetation within the railway reserve to the east. Therefore the area would not be necessary for the maintenance of a significant habitat for fauna.

The proposed clearing is not at variance with this principle.

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

No Threatened (Declared Rare) flora species were found within the proposed clearing area.

The proposed clearing is not at variance with this principle.

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

The proposed clearing area does not intersect with any Threatened or Priority Ecological Community (TEC or PEC, respectively).

The proposed clearing is not at variance with this principle.

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

The area was used for agriculture (pasture) prior to being used for processing activities; therefore, is not remnant vegetation. The vegetation units to be cleared comprise either *Corymbia calophylla* or *Eucalyptus rudis* over pasture or weeds in Completely Degraded condition, or planted non-endemic / exotic species.

The vegetation units are not representative of the pre-European Guildford and Swan Vegetation Complexes which occur in the area. Therefore, the proposed clearing is not expected to have a significant impact on remnant native vegetation complexes at a local, regional or national scale.

The proposed clearing is not at variance with this principle.

3.6 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

The area to be cleared is not located in association with a naturally-occurring watercourse or wetland. The lake is artificial and the surrounding vegetation is classified as "planted". There is no naturally-occurring riparian or wetland vegetation occurring within the areas to be cleared. The artificial lake itself is populated with *Typha orientalis* and vegetation surrounding the lake includes planted non-endemic eucalyptus trees, exotic trees and shrubs with some marri, flooded gum,

peppermint and paperbark over a grassland of introduced species (Harewood 2018), in completely degraded condition (Ecoedge 2015) (Figure 4).

In addition, the area to be remediated includes the wetlands and, once remediated, will be backfilled with clean fill. Therefore, the proposed clearing will not pose a risk to naturally-occurring riparian or wetland vegetation and is not required for the ongoing support of any wetlands.

The proposed clearing is not at variance with this principle.

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

The proposed clearing is for the purpose of remediation and will therefore result in an improvement in the condition of the land.

The area will be re-contoured to a stable, flat self-draining landform (using clean fill where necessary) with any potential surface water ponding resulting from occasional storm events draining via existing channels. The land will be revegetated with pasture to stabilise the surface soils.

Iluka has extensive experience in successfully rehabilitating its mine sites and will apply similar rehabilitation practices to reinstate the landform, following clearing and the removal of contaminating by-products, to improve its overall condition.

The proposed clearing is not at variance with this principle.

3.8 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

The proposed Area Permit area is not located within or near a conservation reserve, or within an Environmentally Sensitive Area (ESA), as per the DWER online clearing permit system map (DWER 2017).

The nearest conservation reserves (Crown Reserve 3249), which was created for fauna conservation purposes, is located approximately 500 m east of the indicative clearing area. Therefore, the proposed clearing is not expected to have an impact on the environmental values of Crown Reserve 3249.

The proposed clearing is not at variance with this principle.

3.9 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

The proposed clearing is for the purpose of remediation in accordance with requirements under the CS Act and will therefore result in an improvement in groundwater quality.

The nearest natural surface water features comprise two creeks located approximately 200 m to the south and approximately 500 m to the north. Both of these creeks are ephemeral and, when water is present, these flow towards the northwest and the Capel River. Given the land will be contoured to a stable, flat landform post remediation and, as such, surface water will infiltrate the ground on site, the risk of impacting surface water quality in these creeks is negligible.

Iluka has extensive experience in successfully rehabilitating its mine sites and will apply similar rehabilitation practices to reinstate the landform, following clearing and the removal of contaminating by-products, and thereby improve surface and groundwater quality.

Remediation activities will occur during summer to limit downstream impacts to surface water. Therefore, active management of surface water is not expected to be required. However, any runoff during remediation will be retained on site through earth bunds as necessary.

The proposed clearing is not at variance with this principle.

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

The CDP is not located within a floodplain as per National Map (Australian Government 2017).

Post remediation, the land will be contoured to a stable, flat, self-draining landform and, as such, will not result in any change in flood risk.

Iluka has extensive experience in successfully rehabilitating its mine sites and will apply similar rehabilitation practices to reinstate the landform. Remediation activities will occur during summer to limit surface water runoff. However, any runoff during remediation will be retained on site through earth bunds as necessary.

The proposed clearing is not at variance with this principle.

3.11 Summary

A summary of the assessment against the ten clearing principals is presented in Table 2.

Table 2 Summary of assessment against the ten clearing principles

Clearing Principal	Is not at variance	May be at variance
Principle (a): Native vegetation should not be cleared if it comprises a high level of biological diversity	x	
Principle (b): Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	x	
Principle (c): Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora	x	
Principle (d): Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	x	
Principle (e): Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	x	
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	x	
Principle (g): Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	x	
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	x	
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	x	
Principle (j): Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding	x	

4 Environmental management

4.1 Environmental Management System

Iluka has an environment, health and safety management system (EHSMS) in place to provide effective EHS management and continuous improvement in performance at all its mineral sands operations. The EHSMS (Figure 6) comprises:

- Iluka's Corporate EHS Policy;
- Fifteen EHSMS standards that describe the minimum requirement for all Iluka areas; and
- Associated policies, procedures and guidelines to assist with the implementation and maintenance of the EHSMS.

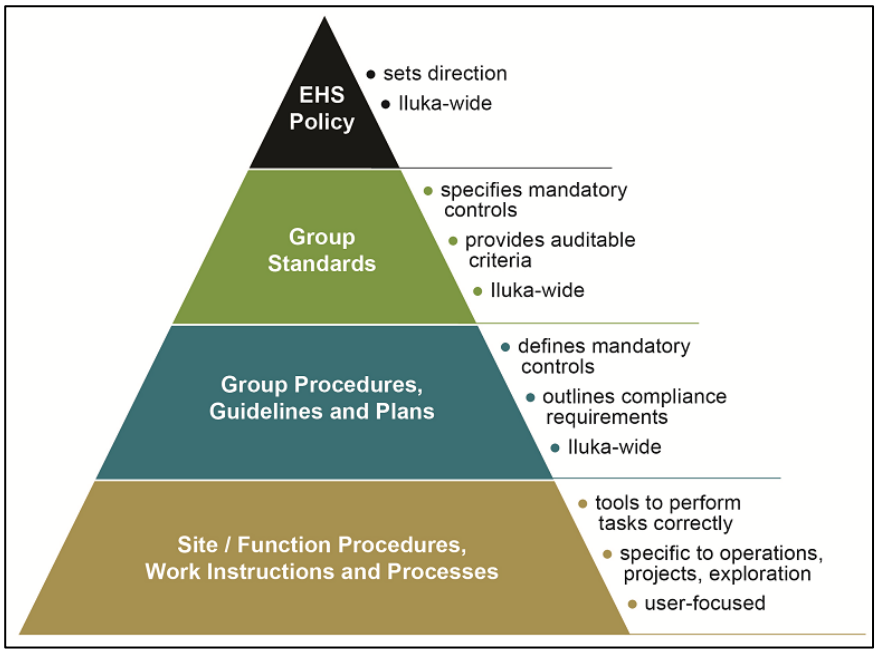

Figure 6 Iluka EHSMS documentation hierarchy

This EHSMS will provide guidance for the SCRP, including the on-ground remediation works.

5 References

Australian Government 2017, *National Map*. Accessed 10/11/2017 http://nationalmap.gov.au/#wa

Department of Water and Environmental Regulation (DWER) 2017, *Clearing Permit Map Viewer*. Accessed 13/11/2017 https://cps.der.wa.gov.au/main.html#%5B%7B%22xclass%22%3A%22app.map.Main%22%7D%2C%7B%22xclass%22%3A%22app.Content%22%7D%5D

Department of Water and Environmental Regulation (DWER) 2018 *Landfill Waste Classification and Waste Definitions 1996 (as amended 2018). Environment Protection Act 1986*

Ecoedge 2015, *Report of Level 1 Flora and Vegetation survey at the Capel Dry Plant, Capel*. Prepared for Iluka Resources Ltd, Perth, Western Australia.

Environmental Protection Authority (EPA) 2016, *Statement of Environmental Principles, Factors and Objectives*, EPA, Western Australia. http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Statement%20of%20Environmental%20Principles%2C%20factors%20and%20objectives_Dec16_1.pdf

Harewood, G. 2010, *Terrestrial Fauna Survey (Level 1) of Capel Dry Plant Study Area, Capel.* Prepared for Iluka Resources Ltd, Perth, Western Australia.

Harewood, G. 2018, *Fauna Assessment, Capel Dry Plant, South Capel Remediation Project*, Prepared for Iluka Resources Ltd. Perth, Western Australia.

Keighery, B.J. 1994, *Bushland Plant Survey; A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.), Western Australia.

APPENDICES

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Appendix A Report of a Level 1 Flora and Vegetation survey at the Capel Dry Plant, Capel (Ecoedge 2015)

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Report of a Level 1 Flora and Vegetation survey at the Capel Dry Plant, Capel

Prepared for Iluka Resources Limited
November 2015

Ecoedge

PO Box 1180 Bunbury WA 6231
9721 1377 | enquiries@ecoedge.com.au

Version	Origin	Review	Review date	Ecoedge release approval	Issue date
V1	M. Strang	R. Smith	15/11/2015		
V2	R. Smith	M. Strang	23/11/2015		
V3	M. Strang	R. Smith	24/11/2015		
V4	M. Strang	R. Smith	25/11/2015		
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Final draft	M. Strang	A. Bishop / A. Riedmann (Iluka)	18/12/2015	M. Strang	26/11/2015
Final	A. Bishop / A. Riedmann (Iluka)	M. Strang, R. Smith	21/12/2015	M. Strang	22/12/2015

Executive Summary

Ecoedge was engaged by Iluka Resources Limited in August 2015 to undertake a Level 1 Flora and Vegetation Survey of remnant vegetation at the Capel Dry Plant to assist with potential future clearing permit applications. The Project Area, which includes Nature Reserve 3249, is 123.1 ha, of which approximately 24.6 ha is remnant native vegetation.

Field assessments were carried out on 21 and 29 September, and 5 and 12 October 2015.

Two hundred and fourteen taxa of vascular flora were identified within the Project Area, of which 54 (25.2%) were exotic species. Two weeds classified as Pest Plants under the under the *Biosecurity and Agriculture Management Act 2007* (**Asparagus asparagoides*, **Zantedeschia aethiopica)* were found within the Project Area, both in the C3 management Category.

Three species of Priority flora were found within Crown Reserve 3249 viz. *Stylidium paludicola* (P3), *Caladenia speciosa* (P4) and *Acacia semitrullata* (P4). No species of Declared Rare flora under the *Wildlife Conservation Act 1950* or plants listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* were found.

Eleven vegetation units dominated by trees or shrubs were identified within the Project Area, of which nine were naturally occurring.

Approximately 0.15 ha of the vegetation unit *Corymbia calophylla - Xanthorrhoea brunonis* open forest (CcXbOF) adjacent to the Capel Dry Plant (on the rail reserve) was in 'Good' or 'Very Good-Excellent' condition and is considered to have high conservation value because is inferred as a new occurrence of the Critically Endangered Threatened Ecological Community *Corymbia calophylla-Xanthorrhoea preissii* Woodlands and Shrublands (SCP 3c).

The vegetation unit *Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland (AsHvMvTS) has similarities to the FCT 'Dense shrublands on Clay Flats (SCP 9)' which is a Threatened Ecological Community with the risk status of 'Vulnerable'. Most of this unit was classed as 'Degraded', however just over 20% of this vegetation unit was assessed as 'Good'.

The vegetation units AfMpLCF, CcMrCF, EmAfMpCF and ErAfMpCF are inferred to represent examples of the Priority 1 Ecological Community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands)'. Almost all of the area of these communities was assessed as 'Good' or 'Very Good/Excellent' condition.

21.6 ha of the 123 ha Project Area comprises native vegetation in a range of condition classes. About 55% of the Project Area was classified as 'Completely Degraded' or 'Degraded' while 21.7% of the area was classed as 'Very Good to Excellent', the bulk of this being in Crown Reserve 3249.

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Statement of limitations

Reliance on Data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

1 Introduction

Ecoedge was engaged by Iluka Resources Limited ('Iluka') in August 2015 to undertake a Level 1 Flora and Vegetation Survey of remnant vegetation at the Capel Dry Plant to assist with potential future clearing permit applications. The Project Area, which includes Nature Reserve 3249, is 123.1 ha, of which approximately 21.6 ha is remnant native vegetation.

A previous survey of a 6.9 ha portion of the current Project Area was undertaken by Mattiske Consulting Pty Ltd in 2009. No Declared Rare or Priority Flora listed under the *Wildlife Conservation Act 1950* (*WC Act*) or under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EBPC Act*) were found during this survey, nor were any Threatened or Priority Ecological Communities identified.

This vegetation survey was undertaken in accordance with the Environmental Protection Authority (EPA) Guidance Statement 51, "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia" (EPA, 2004).

The field assessment was carried out on 21 and 29 September, and 5 and 12 October 2015. This report compiles findings of the field survey.

1.1 Scope and objectives

The scope and objectives of the flora survey were to carry out a Level 1 flora and vegetation assessment to determine whether there are any significant flora values within the Project Area. The survey scope specified the following requirements:

- Conduct an assessment of flora and vegetation values within the Project Area;
- Conduct a review of other literature to summarise the values of flora and vegetation significance in the project area;
- Review the documented flora and vegetation of significance, based on Department of Parks and Wildlife (DPaW) records (databases);
- Conduct field assessments to:
    - identify the vascular flora species present;
    - determine the presence or absence of Declared Rare Flora (DRF), Priority or Significant Species; Record relevant information for each, including species, location, number of individuals/estimated population size;
    - assess conservation significance of vegetation and flora;
    - define and spatially map vegetation condition;
    - define and spatially map vegetation communities (achieved through the installation of a number of floristic relevés);

- define and map threatened and priority ecological communities; and
- a review of the local and regional significance of the plant communities in terms of their intrinsic value, extent and condition against Government of Western Australia (2013a)

1.2 Biogeographic region and location

The Project Area is situated within Perth Coastal Plain (SWA2) sub-region of the Swan Coastal Plain biogeographic region, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Australian Government, 2009). The Project Area is located on the northwest outskirts of the Capel townsite (**Figure 1, Figure 2**), within road reserves, railway, crown land (Nature Reserve) and freehold land in the Shire of Capel.

1.3 Geology

Within the Swan Coastal Plain landform, the Project Area is situated on the Spearwood Dune Zone (211), the Bassendean Dune Zone (212) and Pinjarra Zone (213) (**Figure 3**). The Spearwood Dunes are of aeolian origin and are characterised by a series of limestone-capped peaks. They also feature low dunes and swales of shallow pale grey sands over yellow sands. The Bassendean Dunes lie in the centre of the Swan Coastal Plain (between the Spearwood Dunes and the Pinjarra Plain), and are the oldest of the three aeolian dune systems. They are generally of low relief, often with broad swales or relatively flat sand sheets between the low dunes (Government of Western Australia, 2000). The Pinjarra Zone is defined as alluvial deposits occurring between the Bassendean Dune Zone and the Darling Scarp, and colluvial and shelf deposits adjacent to the Darling Scarp. The soils are clayey to sandy alluvial with wet areas (Schoknecht, *et al*., 2004). There are seven Soil Mapping Units or soil phases occurring within the Project Area, these are described in **Table 1**[1]**.**

[1] The soils in the southern part of the Project Area, particularly along the railway reserve adjacent to the Capel Dry Plant were in fact red-brown loam and brown clay and did not fit the description of the soil mapped by Schoknecht *et al*. (2004).

Table 1. Soil Mapping Units occurring within the Project Area (Barnesby and Proulx-Nixon, 2000).

Soil Mapping Unit	Description
211Sp_S4b	Shallow to moderately deep siliceous yellow-brown and grey-brown sands with minor limestone outcrop.
212Bs_B1	Deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
212Bs_B1a	Deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
212Bs_B2	Well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
212Bs_B3	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.
213Pj_P1a	Deep acidic mottled yellow duplex (or 'effective duplex') soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.
213Pj_P9	Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.

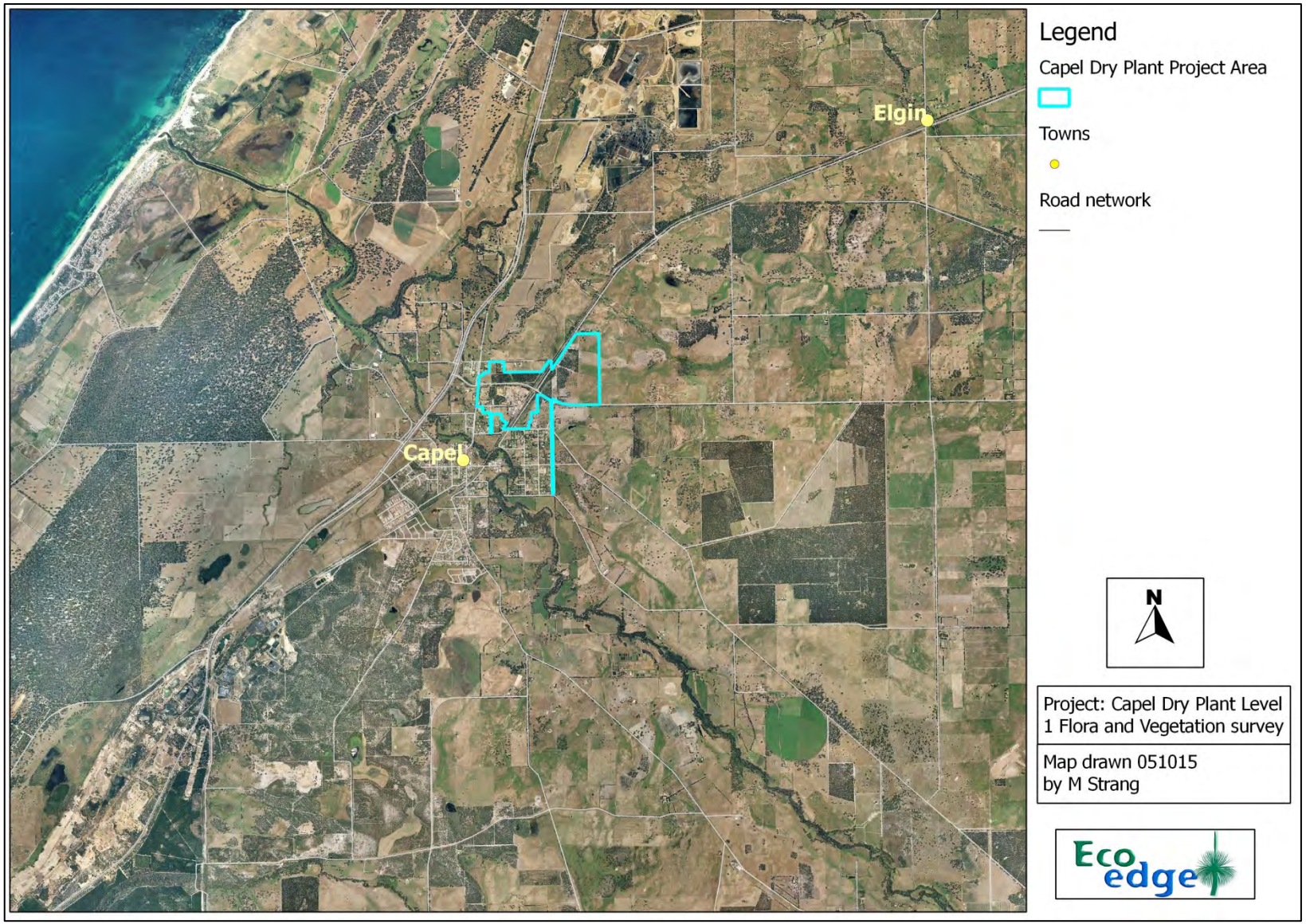

Figure 1. Aerial Photograph showing location of Project Area.

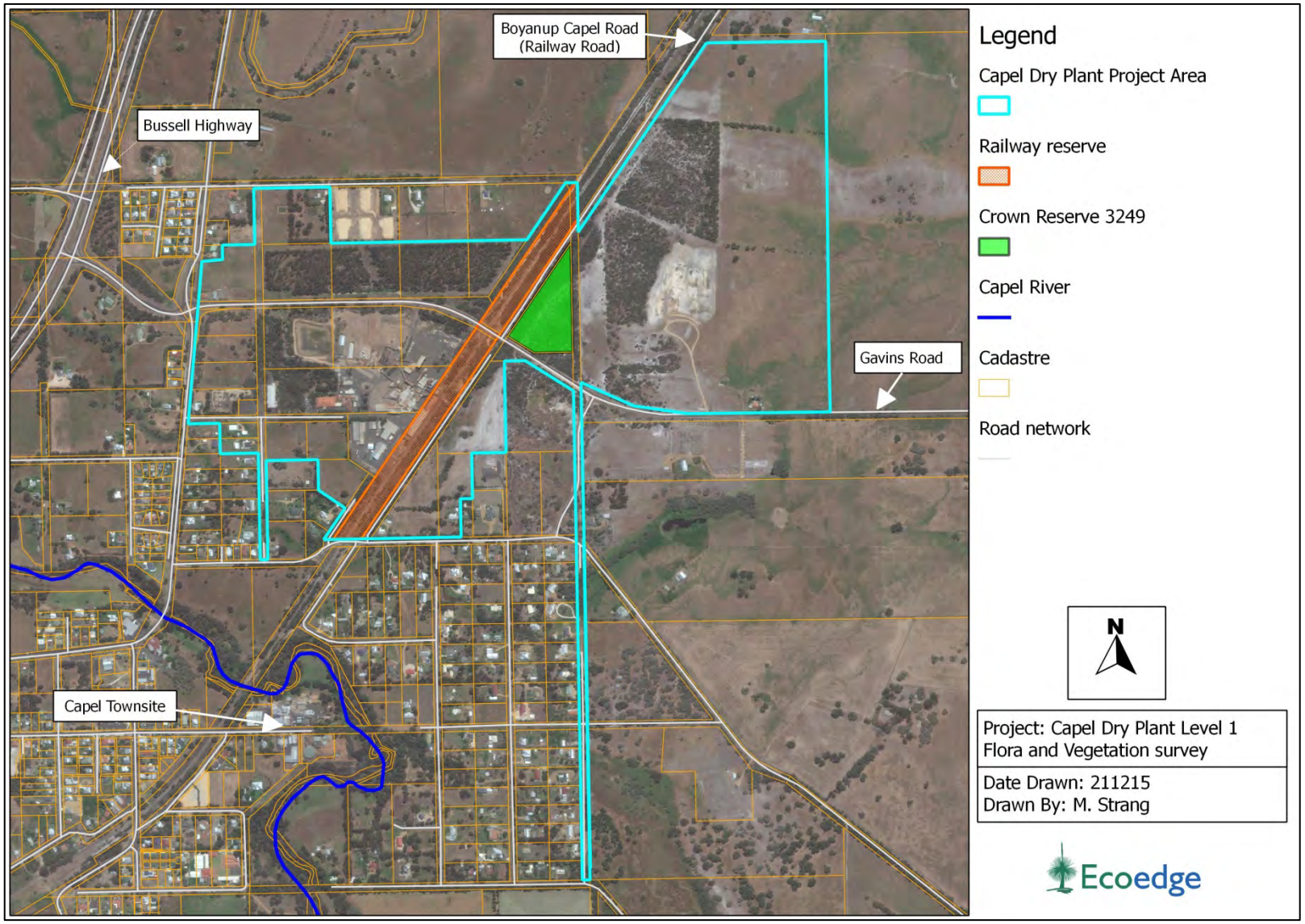

Figure 2. Location of the Project Area in relation to landscape features, the railway reserve and Nature Reserve 3249.

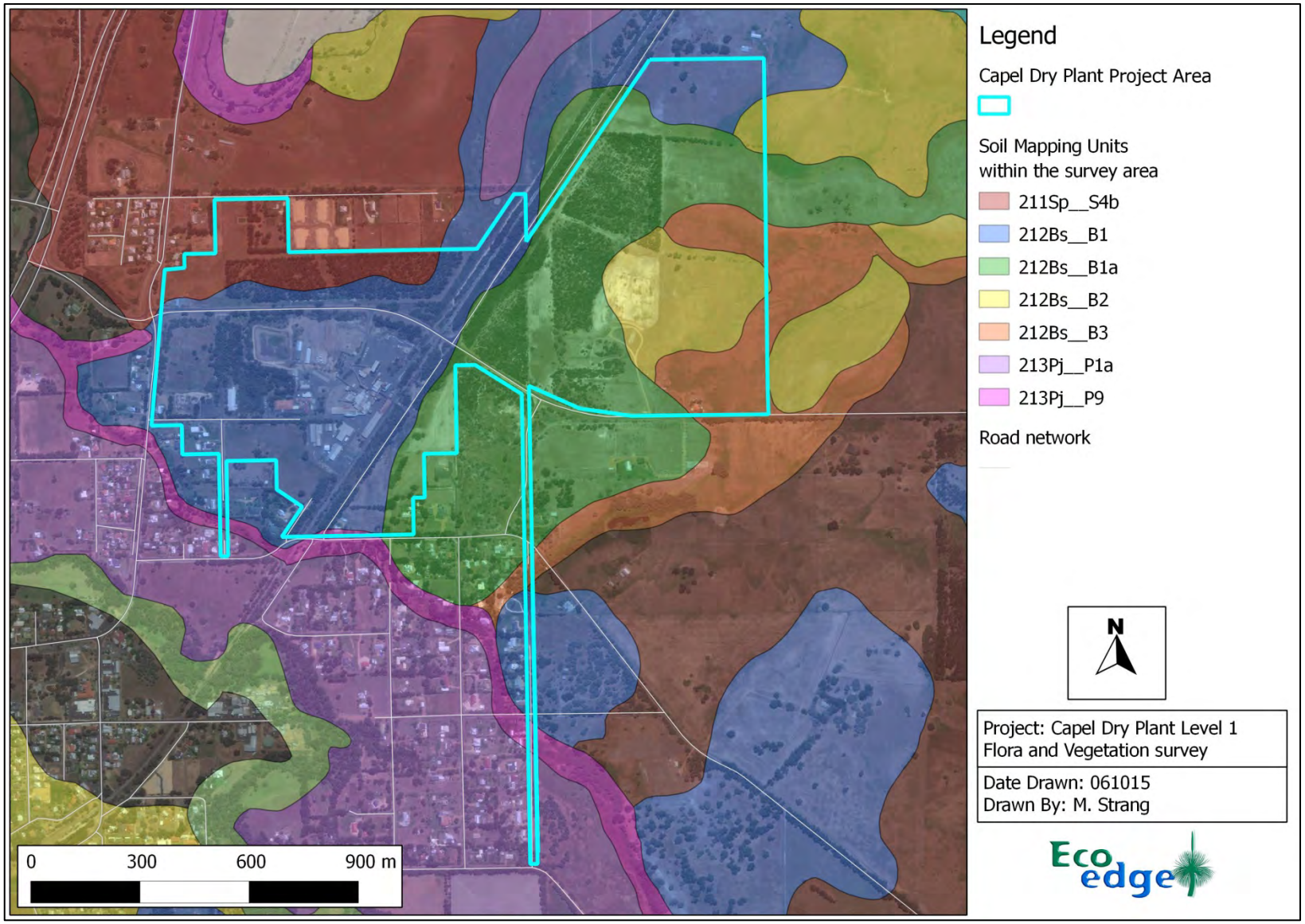

Figure 3. Soil Mapping Units occurring within the Project Area (Barnesby and Proulx-Nixon, 2000).

1.4 Vegetation

Variation in vegetation mainly reflects the variations in soil and moisture condition of a landscape. Historically, the vegetation types in the Project Area would have reflected the topography and soils, with the Swan Coastal Plain vegetation being distinct from that found on the slopes of the Darling Scarp.

Heddle *et al*. (1980) mapped the vegetation of part of the Drummond Botanical Sub-district at a very broad scale, describing a series of vegetation complexes that are related groups of vegetation associations found on particular landform-soil units. A total of 38 vegetation complexes were mapped on the Swan Coastal Plain. As shown in **Figure 4**, remnant vegetation within the Project Area was mapped as the Southern River, Guildford and Swan Complexes, which are described in **Table 2.**

Vegetation of the Southern River Complex is characterised by being in transition between the Pinjarra Plain and the Bassendean Dunes. This complex supports vegetation communities associated with the Bassendean Dunes but also those associated with pockets of alluvial and colluvial soils characteristic of the Pinjarra Plain.

Table 2. Vegetation Complexes mapped by Heddle *et al*. (1980) as occurring within the Project Area.

Vegetation Complex	Description
Southern River	This vegetation is described as open woodland of *Corymbia calophylla* - *Eucalyptus marginata* - Banksia species with fringing woodland of *Eucalyptus rudis* - *Melaleuca rhaphiophylla* along creek beds.
Guildford	A mixture of open forest to tall open forest of *Corymbia calophylla* - *Eucalyptus wandoo* - *Eucalyptus marginata* and woodland of *Eucalyptus wandoo* (with rare occurrences of *Eucalyptus lane-poolei*). Minor components include *Eucalyptus rudis* - *Melaleuca rhaphiophylla*.
Swan	Fringing woodland of *Eucalyptus rudis* - *Melaleuca rhaphiophylla* with localised occurrence of low open forests of *Casuarina obesa* and *Melaleuca cuticularis*.

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia, 2001). This level of recognition is in keeping with the targets set in the EPA's Position Statement on the 'Environmental protection of native vegetation in

Western Australia: clearing of native vegetation, with particular reference to the agricultural area' (EPA, 2000). With regard to conservation status, the EPA has set a target of 15% of pre-European extent for each ecological community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

Table 3 lists the percentage remaining of each vegetation complex and the percentage of each vegetation complex in formal and formal plus informal reserves. It also lists whether each vegetation complex meets the Commonwealth's 30% target (Environment Australia, 2001) and the EPA's 15% target (EPA, 2006). As is evident in **Table 3** all of the vegetation complexes present within the Study Areas meet the Commonwealth's 30% target and the EPA's 15% target.

Table 3. Vegetation Complexes present in the Capel Dry Plant Project Area with regard to the EPA and Commonwealth retention targets (DEC 2007).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% in Formal Reserves	% in Formal + All Informal Reserves	Is the 15% Target Met?
Southern River	11.12%	No	4.0%	4.0%	No
Guildford	4.14%	No	0%	0%	No
Swan	13.11%	No	0%	0%	No

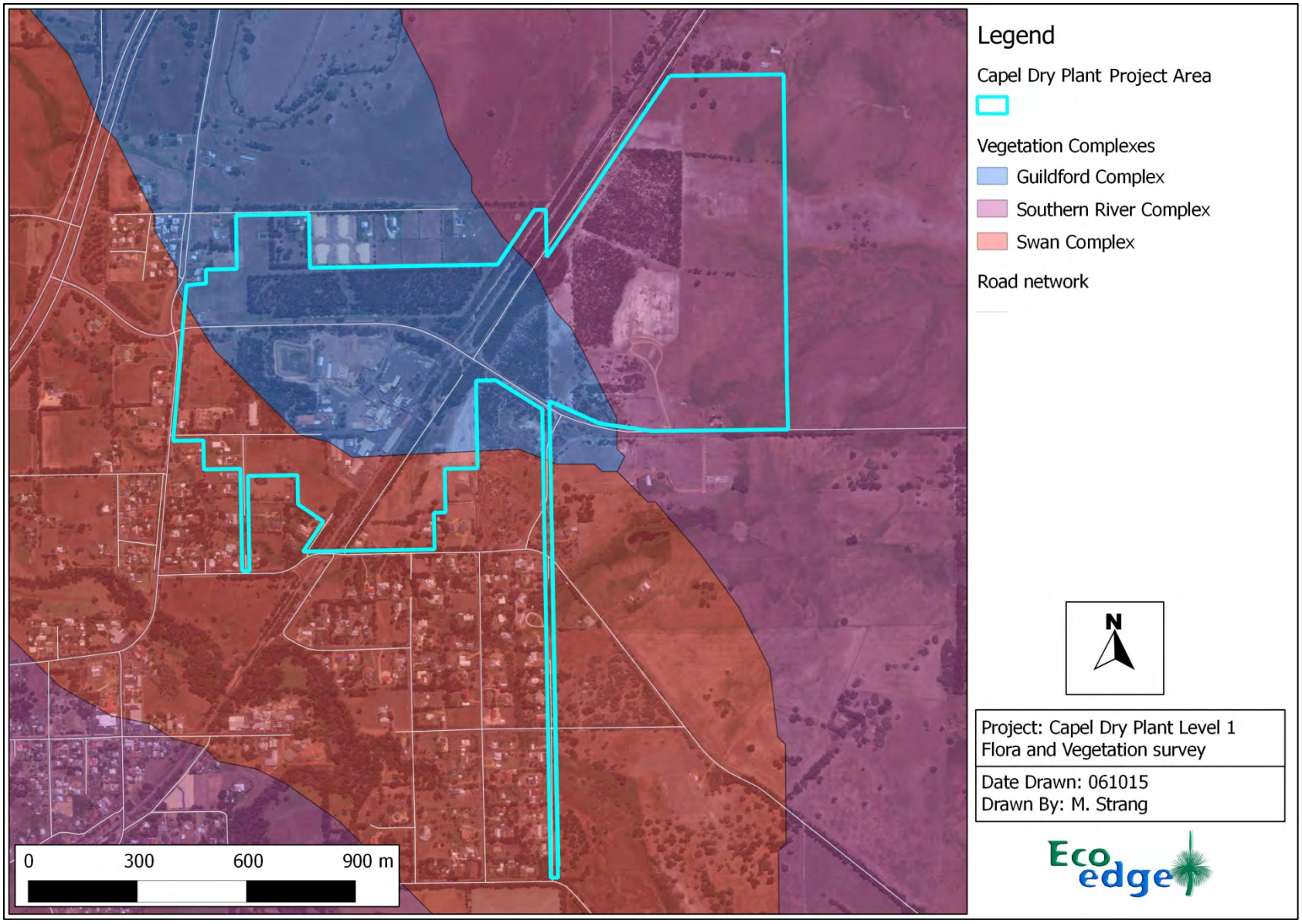

Figure 4. Vegetation complexes mapped by Heddle *et al*.(1980) as occurring within the Project Area.

1.5 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's Department of Parks and Wildlife (DPaW, previously the Department of Environment and Conservation (DEC)) as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC, 2010).

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; 'presumed totally destroyed', Critically Endangered (CE), Endangered (E) or Vulnerable (V) (DEC, 2010). Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2010). The current listing of Threatened and Priority Ecological Communities is specified in DPaW, 2015a and 2015b.

Threatened Ecological Communities can also be listed under the Commonwealth *EPBC Act* (Department of the Environment (DotE), 2015a; Department of Environment, Water, Heritage and the Arts (DEWHA), 1999). There are three categories of TEC under the *EPBC Act*: Critically Endangered (CE), Endangered (E) and Vulnerable (V). These are defined in **Table 4**.

Table 4. Categories of Threatened Ecological Communities under the *EPBC Act*.

Category	Definition
Critically endangered	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

A Protected Matters Search Tool query for communities listed under the *EPBC Act* occurring within a 5 km radius of the Project Area was undertaken (DotE, 2015b, **Appendix 1**), and the current DPaW TEC and PEC listings were consulted (DPaW 2015a; 2015b).

Threatened and priority ecological communities known to occur within 5 km of the Project Area are listed in **Table 5.**

Table 5. Threatened ecological communities occurring within 5 km of the Project Area (Gibson *et al*., 1994; DPaW, 2015a; DotE, 2015b).

Community Name	Community Description	Status (WA)	Status (*EPBC Act*)
SCP 1b – Southern *Corymbia calophylla* woodlands on heavy soils	Dominated by *C. calophylla* and *Eucalyptus marginata. Acacia extensa, Hypocalymma angustifolium* and *Xanthorrhoea preissii* are important shrubs. Mainly occurs south of Capel.	VU	
SCP 3c – *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain	*Corymbia calophylla – Xanthorrhoea preissii woodlands and shrublands.* Eucalyptus wandoo is an occasional dominant. This community occurs on heavy soils.	CR	EN
SCP 09 - Dense shrublands on clay flats	Shrublands or open woodlands of clay flats that are inundated for long periods.	VU	CR
SCP 21b - Southern *Banksia attenuata* woodlands	Structurally, this community type is normally *Banksia attenuata* or *Eucalyptus marginata – B. attenuata* woodland. Common taxa include *Acacia extensa, Jacksonia* sp. *Busselton, Laxmannia sessiliflora, Lysinema ciliatum* and *Johnsonia acaulis.*	P3	

1.6 Threatened and Priority Flora

Species of flora and fauna are defined as having Declared Rare (Threatened) or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment Regulation recognises these threats of extinction and consequently applies regulations towards population and species protection.

Declared Rare (Threatened) Flora species are gazetted under Subsection 2 of Section 23F of the *WC Act* and therefore it is an offence to 'take' or damage rare flora without Ministerial approval. Section 6 of the *WC Act* defines 'to take' as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Priority Flora are under consideration for future declaration as 'rare flora', dependent on more information. Species classified as Priority One to Three are in need of further survey to determine their status, while Priority Four species require monitoring every 5-10 years. **Table 6** presents the categories of Threatened and Priority Flora as defined by the *WC Act* (DPaW 2014).

Table 6. Definitions of Declared Rare and Priority List flora (DPaW, 2014).

Conservation code	Category
T (DRF)	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.
P1	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
P4	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Under the *EPBC Act,* a species may be listed in one of six categories; the definitions of these categories are summarised in **Table 7** (DotE, 2015c).

Threatened or Priority flora occurring within 10 km of the Project Area generated from a NatureMap data search (DPaW, 2015c) are listed in **Table 8**. Taxa listed under the *EPBC Act* potentially occurring within 5 km of the Project Area (based on results of the Protected Matters Search Tool query) are listed in **Appendix 1**.

Table 7. Categories of Threatened Species under the *EPBC Act* (DotE, 2015c).

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the ***extinct*** category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Table 8. List of Declared Rare and Priority List flora known to occur within 5 km of the Project Area.
(The *WC Act* Conservation Status is shown, *EPBC Act* status is in brackets.)

Species	Cons[2]. Status	Flowering	Habitat	Likelihood of Occurrence
Calectasia cyanea	T	Jun-Oct	White, grey or yellow sand, gravel.	Moderate
Diuris drummondii	T (V)	Nov-Jan	Low-lying depressions, swamps.	Moderate
Drakaea elastica	T (E)	Oct-Nov	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Moderate/High
Verticordia densiflora var. *pedunculata*	T (E)	Dec or Jan	Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	Moderate
Bolboschoenus medianus	P1	Sept-Dec	Mud. In water and on river banks.	Moderate
Amperea micrantha	P2	Oct-Nov	Sandy soils.	Moderate
Calytrix sp. Tutunup (G.J. Keighery & N. Gibson 2953)	P2	Oct	Yellow-grey clayey loam, red clayey loam, laterite, ironstone. Slopes and flats, winter-wet areas, grazed paddocks.	Low
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	*Pericalymma ellipticum* wet shrubland, Marri-Jarrah woodland.	Moderate
Synaphea petiolaris subsp. *simplex*	P2	Sep-Oct	Sandy soils. Flats, winter-wet areas.	Moderate/High
Trichocline sp. Treeton (B.J. Keighery & N. Gibson 564)	P2	Nov-Jan	Sand over limestone, sandy clay over ironstone. Seasonally wet flats.	Low
Adelphacme minima	P3	Spring	Not confirmed	Low/Moderate
Boronia tetragona	P3	Oct-Dec	Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Moderate
Chamaescilla gibsonii	P3	Sep	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Low

[2] Conservation

Species	Cons[3]. Status	Flowering	Habitat	Likelihood of Occurrence
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Low/Moderate
Lasiopetalum membranaceum	P3	Sep-Dec	Sand over limestone.	Low
Loxocarya magna	P3	Sep or Nov	Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Moderate/High
Meeboldina thysanantha	P3	Dec	Sand. Swamps.	Moderate/High
Pultenaea pinifolia	P3	Oct-Nov	Loam or clay. Floodplains, swampy areas.	Moderate/High
Stylidium paludicola	P3	Oct-Dec	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Moderate
Synaphea hians	P3	Jul-Nov	Sandy soils. Rises.	Low
Tetratheca parvifolia	P3	Oct	Jarrah, woodland, wandoo woodland, gravelly soils.	Low
Thelymitra variegata	P3	Jun-Sep	Sandy clay, sand, laterite.	Low
Verticordia attenuata	P3	Dec-May	White or grey sand. Winter-wet depressions.	Moderate/High
Acacia flagelliformis	P4	May-Sep	Sandy soils. Winter-wet areas.	Moderate/High
Acacia semitrullata	P4	May-Oct	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Moderate/High
Aponogeton hexatepalus	P4	Jul-Oct	Mud. Freshwater: ponds, rivers, claypans.	Moderate/High
Caladenia speciosa	P4	Sep-Oct	White, grey or black sand.	Moderate/High
Eucalyptus rudis subsp. *cratyantha*	P4	Jul-Sep	Loam. Flats, hillsides.	Moderate/High
Franklandia triaristata	P4	Aug-Oct	White or grey sand.	Low
Stylidium striatum	P4	Oct-Nov	Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	Low
Thysanotus glaucus	P4	Oct-Mar	White, grey or yellow sand, sandy gravel.	Low

[2, 3] Conservation

Many of the species listed in **Table 7** could potentially occur within the Project Area, based on an assessment of their preferred habitats. All species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

1.7 Ecological Linkages

Information for this section is taken from Molloy *et al*. (2009) and their report on the South West Regional Ecological Linkages (SWREL) Project.

Ecological linkages are defined as:

"*A series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape*."

Regional ecological linkages link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas.

The SWREL report is the result of collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan* to provide a tool for the identification of ecological linkages and guidance for the protection of linkages through planning policy documents.

Molloy *et al.* (2009) assessed and assigned 'proximity values' to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in **Figure 5.** It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

A regional ecological linkage axis line passes directly through the Project Area (**Figure 6**). While the axis line is situated slightly away from the vegetation along the railway line, it is most likely meant to align directly with this vegetation. As a result of the location of this axis line, vegetation within the Project Area is assigned to proximity category '1a', '1b', 1c and 2a, which are the four highest categories, and indicates that vegetation within the Project Area forms part of a regional ecological linkage.

Vegetation along the railway line within the Project Area links in the southwest to vegetation along the Capel River and in the north with vegetation in Nature Reserve 3249 and along the road reserve and railway line along Capel-Boyanup Road, eventually linking to State Forest 27 east of Boyanup.

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages have been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

> *"In preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of ecological linkage"* (EPA, 2009).

Figure 5. Linkage proximity values assigned to patches of remnant vegetation within a landscape (Molloy *et al*., 2009).
Note: in Figure 5, 'linkage' refers to the linkage axis line.

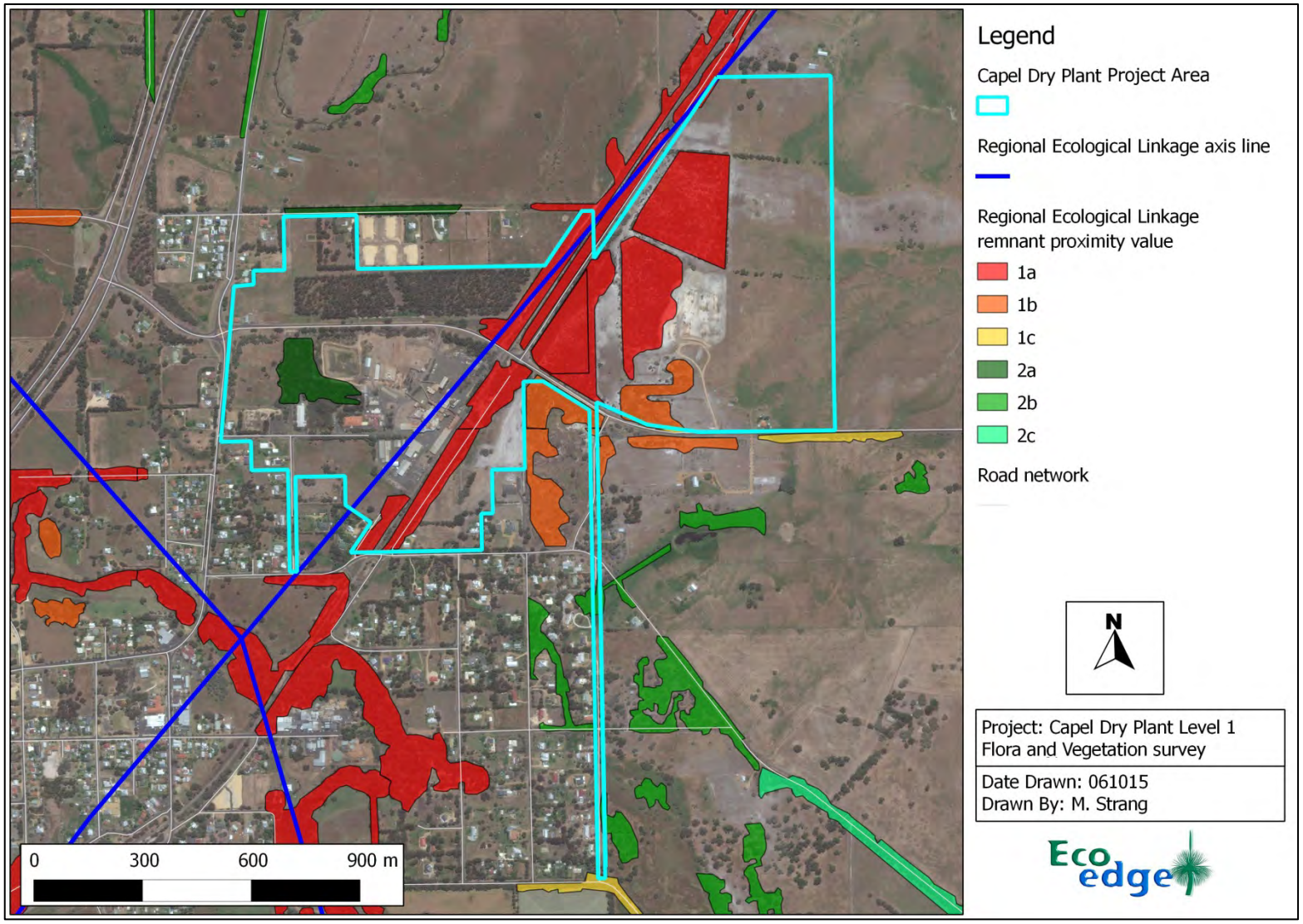

Figure 6. The Project Area in relation to regional ecological linkages (Molloy *et al.*, 2009).

2 Methods

2.1 Desktop Study

Prior to the field survey, a 'desktop survey' was carried out by downloading from NatureMap (DPaW, 2015c) a list of all flora (including rare flora) occurring within 10 km of the Project Area. A Protected Matters Search Tool report was also generated, detailing all species listed under the *EPBC Act* (DotE, 2015b) (**Appendix 1**). A download of data from the DEFL and W.A. Herbarium databases (dated September 2015) of records occurring within 5 km of the Project Area was also accessed. This data was used to establish the list of DRF and Priority flora to target during the survey, as well as providing a list of what other plant taxa might be encountered during the survey.

Vegetation condition was assessed against the method of Keighery (1994) (**Table 9**).

Table 9. Vegetation condition ratings according to Keighery (1994).

Score	Description
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

2.2 Field Survey

The initial assessment was carried out on 21 and 29 September 2015. The random meander method as described in Cropper (1993) was used to search for rare flora. Follow-up visits to the site occurred on 5 and 12 October to gather more information on late-flowering species and to gather information for refining vegetation mapping. A comprehensive list of native and introduced species was compiled. Photographs were taken and notes on species composition, vegetation structure and vegetation condition were compiled at fifty three unmarked relevés within the Project Area to be used, along with aerial photography, in mapping vegetation type and condition.

In addition to the unmarked relevés, a 100 m^2 floristic quadrat was marked out by metal stakes within an area of *Corymbia calophylla-Xanthorrhoea brunonis* open forest CcXbOF rated as "very good-excellent" condition. A species list of the flora within this area was compiled to assist with further analysis of the status of this community.

Flora species that were not identified in the field were collected or photographed for later identification. Taxonomy and conservation status of flora species was checked against Department of Parks and Wildlife databases (DPaW, 2015d and 2015e). No attempt was made to identify all of the 'amenity' species planted near the Iluka offices or other buildings within the Project Area.

2.3 Survey limitations

Potential limitations with regard to the assessment are addressed in **Table 10**.

Table 10. Limitations with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Negligible	The survey was carried out in September and October- a time which experience has shown to be the prime flowering time for flora on the southern Swan Coastal Plain. It is estimated that 90-95% of species in the remnant vegetation were identified.
Availability of contextual information	Low	Comprehensive regional surveys of remnant vegetation, as well as more localised surveys, have been carried out on the southern Swan Coastal Plain.
Completeness of the survey	Negligible	Vegetation within the Project Area was thoroughly search on foot. Further assessments outside the spring season would add to the completeness of the species list but probably only marginally affect the conclusions presented.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical survey in south west Australia over a period of 25 years.
Climatic conditions	Moderate	Winter rainfall for the Project Area was only about 70% of the long-term average and this had a noticeable effect on flowering period.

3 Results

3.1 Flora

Two hundred and fourteen taxa of vascular flora were identified within the Project Area, of which 54 (25.2%) were exotic species (**Appendix 2**). These exotic species are mainly those which are naturalised, or semi-naturalised within the remnant vegetation: as explained above, 'amenity' species planted near offices and other buildings were not identified. The plant family with the highest representation was the Fabaceae with 27 species (including 11 species of *Acacia*), of which seven were exotic. The next highest representation at the family level were Myrtaceae (19 species, including 2 exotics), Poaceae (18: 11), Cyperaceae (15: 1), Proteaceae (14) and Orchidaceae (13).

Two weeds classified as C3 (management) Category Pest Plants under the under the *Biosecurity and Agriculture Management Act 2007* (**Asparagus asparagoides* (Bridal Creeper), **Zantedeschia aethiopica* (Arum Lily)) were found within the Project Area. The location of these weeds within the Project Area is shown in **Figure 7**.

3.2 Rare Flora

3.2.1 *Drakaea elastica* (DRF)

Two separate occurrences of the DRF orchid species *Drakaea elastica* are shown by the Declared Endangered Flora (DEFL) database to be present within the Project Area. Both of these records are more than five years old (2006, 2009). Due to inaccurate latitude and longitude information associated with the records, they are shown in a different location than they were actually found (based on the description of their location in the DEFL record) when mapped.

The 2006 collection, when mapped using the coordinates provided with the record, is shown to be located south 125 m south of the junction of Gavins Road and Capel-Boyanup Road, when in actual fact according to the description given with the record the *Drakaea elastica* plant occurred on the 'north verge' at the junction of the two roads. In addition, a precise description of their location provided with the 2009 collection also allows the actual location of the three *D. elastica* plants sighted at that time to be found.

A thorough search of the locations of the two *D. elastica* occurrences recorded in DEFL failed to find any of the plants. The site of the 2006 collection at the junction of Gavins Road and Capel-Boyanup Road appears to have been impacted by physical disturbance since that time and it is likely that this sub-population (3B) is extinct. The three plants recorded for the 2009 DEFL collection "38 m uphill from SECWA pole No 302 within 1 m E of dead banksia tree" are also possibly no longer extant, this area having been severely impacted by *Phytophthora* dieback disease.

3.2.2 *Stylidium paludicola* (P3)

Four of the Priority 3 species, *Stylidium paludicola*, were found 125 m north of the junction of Gavins Road and Capel-Boyanup Road within Crown land reserve 3249 (**Figure 7, Figure 8** and **Table 11**). These are close to a 2003 WA Herbarium collection record for the same species.

3.2.3 *Caladenia speciosa* (P4)

Three plants of the Priority 4 orchid *Caladenia speciosa* were found within *Banksia attenuata – B. ilicifolia* woodland in Crown land reserve 3249 (**Figure 7**, **Figure 9** and **Table 11**)

3.2.4 *Acacia semitrullata* (P4)

Acacia semitrullata (Priority 4) was found in four locations within *Banksia attenuata – B. ilicifolia* woodland in Crown land reserve 3249 (**Figure 7**, **Figure 10** and **Table 11**).

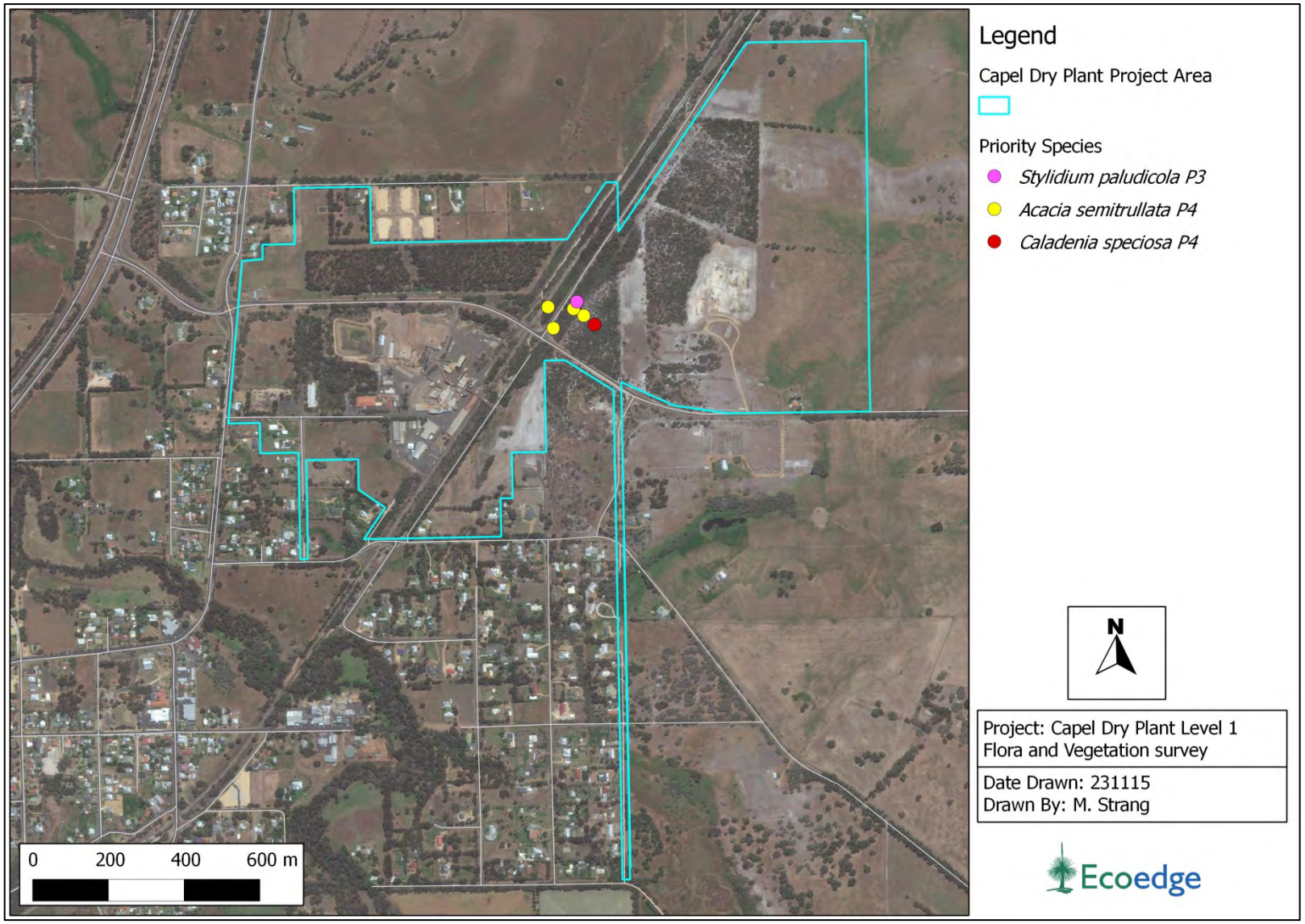

Figure 7. Locations of Priority flora species with the Capel Dry Plant Project Area.

Figure 8. *Stylidium paludicola* (P3).

Figure 9. *Caladenia speciosa* (P4).

Figure 10. *Acacia semitrullata* (P4).

Table 11. Coordinates of Priority flora found within the Project Area.

Species	Easting	Northing	No. of plants
Stylidium paludicola (P3)	367686.94	6287508.64	4
Caladenia speciosa (P4)	367732.26	6287448.21	3
Acacia semitrullata (P4)	367703.83	6287473.09	1
	367676.28	6287489.09	1
	367622.97	6287437.55	1
	367608.75	6287495.31	1

3.3 Conservation Status of the DRF and Priority Flora within the Project Area

Crown land reserve (Nature Reserve) 3249 contained all of the Priority species that were found during this survey, and where two sub-populations of the DRF species *Drakaea elastica* were previously located. *Drakaea elastica* was declared as Rare Flora under the Western Australian *WC Act* in July 1988 and is ranked as Critically Endangered (CR) under World Conservation Union criteria due to the severe fragmentation of populations and the continuing decline in the area, extent and quality of habitat and number of mature individuals (DotE, 2015e).

It is possible that the two sub-populations *of D. elastica* within the Project Area have declined because of declining autumn-winter rainfall in the south west of Western Australia (BOM, 2015) and a decline in overstorey cover within Reserve 3249. Dieback disease has been active within the reserve and has removed the *Banksia* overstorey in the vicinity of one of the sub-populations. Increased survival of *D. elastica* in more shaded compared to more exposed sites has been observed and may be related to increased heat stress in exposed sites (Carstairs and Coates, 1994).

Stylidium paludicola was recently listed as Priority Three under DPaW Conservation Codes for Western Australian Flora. It is found in seasonally wet localities in grey to black peaty sand over clay. *S. paludicola* has a scattered distribution in a region (the Swan Coastal Plain from Bullsbrook to Capel) marked by extensive land clearing and subject to ongoing development pressures. Only a small number of populations are known from nature reserves and population sizes and threats are not known. Further survey is required (Wege, 2014).

Both *Caladenia speciosa* and *Acacia semitrullata*, being in the Priority 4 category, are considered to have been adequately surveyed or for which sufficient knowledge is available, and are considered not currently threatened or in need of special protection, but could be if present circumstances change (DPaW, 2014). These species are usually represented on conservation lands, as is the case with their occurrence within the Project Area.

3.4 Pest Plants

Two exotic species found within the Project Area; Bridal Creeper (**Asparagus asparagoides*) and Arum Lily (**Zantedeschia aethiopica*) are Declared Pest Plants within the C3 (management) Category for the whole of Western Australia. The distribution of these pest plants is shown in **Figure 11**.

3.5 Vegetation Units

Eleven vegetation units dominated by trees or shrubs were identified within the Project Area (**Table 12, Figure 12**). One of these units, which is not discussed further, is dominated by plantations of exotic species of trees such as Blue Gum (*Eucalyptus globulus*). Another unit (Code named 'Cc/Er_pasture') is composed primarily of exotic weed or pasture species with an overstorey primarily of *Corymbia calophylla* (Marri), but also in places by *Eucalyptus rudis* subsp. *cratyantha* (Flooded Gum). *E. rudis* subsp. *cratyantha* is classified as Priority 4 because much of its original habitat has been cleared and the trees that are left are often subjected to multiple disturbances, such as a drying climate, grazing by livestock and severe attack by insects.

The vegetation units ('floristic community types': FCTs) of the southern Swan Coastal Plain were originally defined by Gibson *et al.* (1994) 'the Swan Coastal Plain survey'). Webb *et al*. (2009) in their report on the flora and vegetation of the Busselton Plain describe a number of communities that were not identified by the survey by Gibson *et al.*

The vegetation of sites on the Swan Coastal Plain can be placed within established FTCs by the use of data from floristic quadrats followed by multivariate analysis, or by comparison of a list of species from a vegetation unit at the new site with a list of the characteristic species of the floristic community types defined by Gibson *et al*. (1994). However, because not all remnant vegetation was sampled during the Swan Coastal Plain survey there are vegetation units (particularly wetland communities) that do not fit neatly into any of the defined FCTs.

In **Table 13**, below, the vegetation units of the Project Area are paired with their closest match from the communities described in Gibson *et al*. (1994) or the communities of Webb *et al*. (2009) (if a close fit could not be found in the former source). The matches were based on a comparison of the species composition of the vegetation units of the Project Area (**Appendix 3**) with the FCTs described in Gibson *et al*. (1994) or the communities of Webb *et al*. (2009). Photographs of the vegetation units are included in **Appendix 4.**

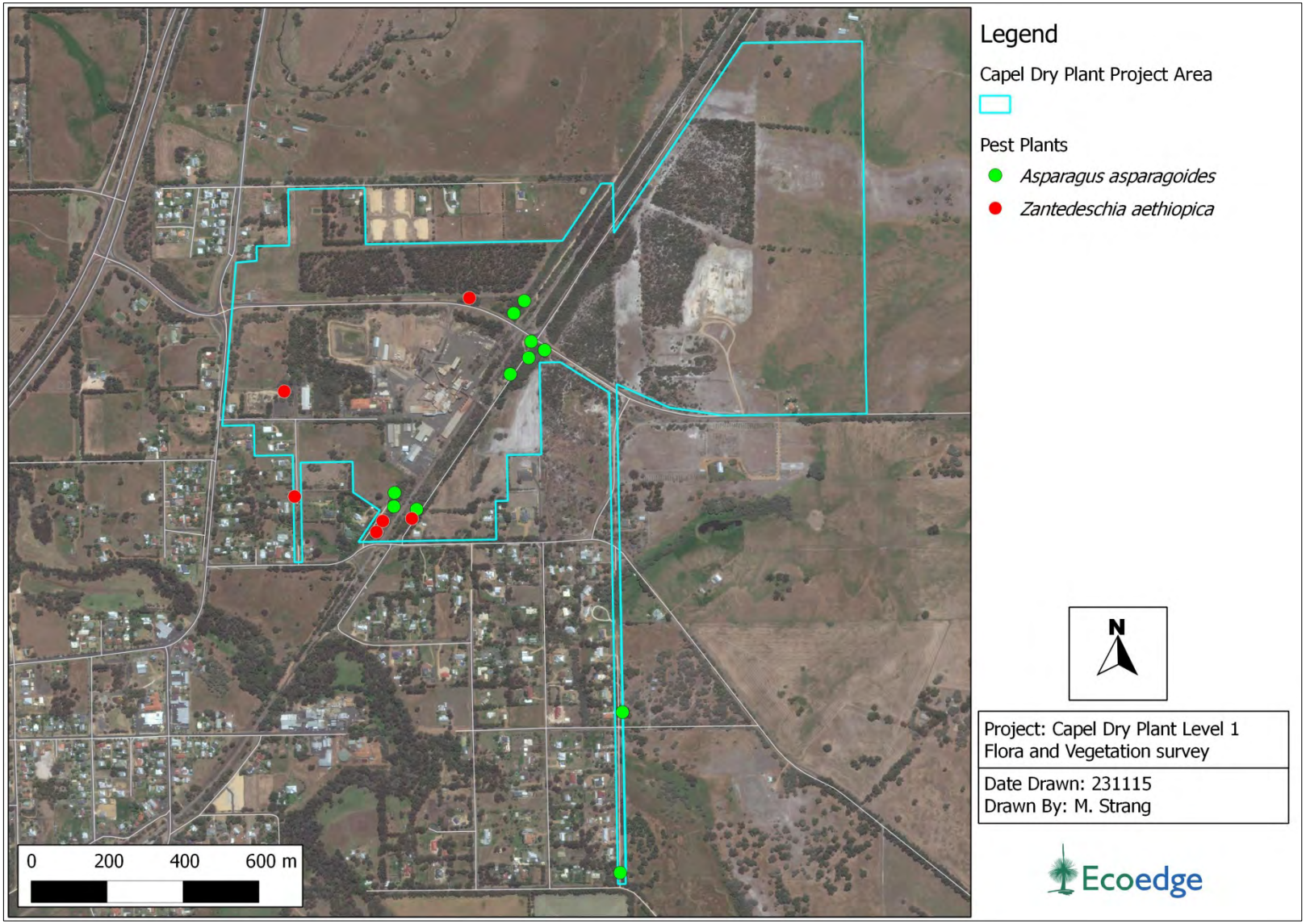

Figure 11. Location of pest plants within the Project Area.

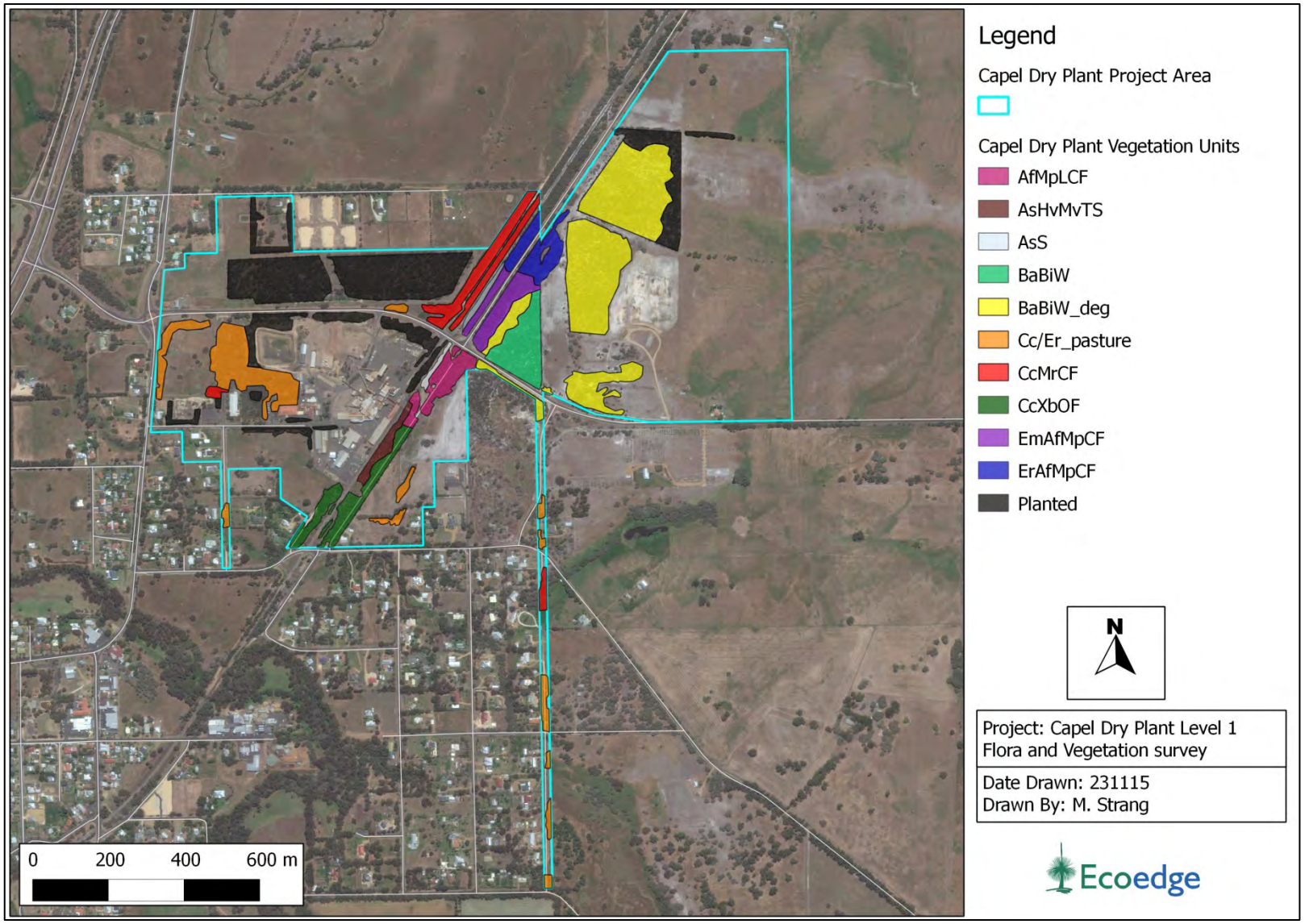

Figure 12. Vegetation units in the Project Area.

Table 12. Vegetation Units within the Project Area.

CODE	NAME	DESCRIPTION
AfMpLCF	*Agonis flexuosa-Melaleuca preissiana* low closed forest	Low forest of *Agonis flexuosa* and *Melaleuca preissiana* (with occasional emergent *Corymbia calophylla*) over a sparse shrub understorey including *Astartea scoparia Dasypogon bromeliifolius*, *Xanthorrhoea gracilis* and exotic grasses including **Eragrostis curvula* on grey sand with thick leaf litter.
AsHvMvTS	*Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland	Tall shrubland of *Acacia saligna*, *Astartea scoparia*, *Hakea varia*, *Melaleuca viminea* and *Viminaria juncea* with occasional low shrubs of *Synaphea petiolaris* over a sparse herbaceous understorey that includes *Austrostipa mollis*, *Caesia micrantha*, **Eragrostis curvula*, **Sparaxis bulbifera* and **Watsonia meriana* on brown clay.
AsS	*Astartea scoparia* shrubland	Shrubland to open heath of *Astartea scoparia* over sedgeland of *Lepidosperma longitudinale* and *Meeboldina* spp.
BaBiW	*Banksia attenuata-Banksia ilicifolia* woodland	Woodland/low woodland of *Banksia attenuata* and *B. ilicifolia* with emergent *Eucalyptus marginata* over tall open shrubland including *Kunzea glabrescens* over *Allocasuarina humilis*, *Dasypogon bromeliifolius*, *Hibbertia hypericoides*, *Hypocalymma robustum*, *Stirlingia latifolia* over open herbs, grasses and sedges including *Burchardia congesta*, *Conostylis aculeata*, **Ehrharta calycinus* and **Ursinia anthemoides* on grey sand
BaBiW_deg	*Banksia attenuata-Banksia ilicifolia* woodland (degraded)	Woodland/low woodland or tall shrubland of *Banksia attenuata*, *B. ilicifolia* over *Kunzea glabrescens* (with emergent *Eucalyptus marginata* – often dead) over a sparse understorey including the shrubs *Dasypogon bromeliifolius* and *Hibbertia vaginata* and a mainly introduced herbaceous layer including **Arctotheca calendula*, **Ehrharta longiflora*, **Hypochaeris glabra* and **Ursinia anthemoides* on grey sand.
Cc/Er_pasture	*Corymbia calophylla* or *Eucalyptus rudis* over pasture or weeds	*Corymbia calophylla* or occasionally *Eucalyptus rudis* over mainly exotic grasses including **Avena fatua*, **Ehrharta longiflora*, **E. calycina*, **Eragrostis curvula* on red-brown loam
CcMrCF	*Corymbia calophylla-(Eucalyptus rudis)-Melaleuca rhaphiophylla* closed forest	Closed forest/low forest to open forest of *Corymbia calophylla* and *Eucalyptus rudis* (occasional) over *Melaleuca rhaphiophylla* over open shrubland of *Astartea scoparia*, *Acacia saligna* and *Viminaria juncea* over sedgeland of *Baumea vaginalis*, *Cyathochaeta avenacea* and *Lepidosperma longitudinale* with (in degraded areas) exotic herbs and grasses including **Acacia longifolia*, **Asparagus asparagoides*, **Plantago lanceolata* and **Watsonia meriana* on red-brown or grey-brown clay loam
CcXbOF	*Corymbia calophylla -Xanthorrhoea brunonis* open forest	Open forest of *Corymbia calophylla* over an open shrubland of *Xanthorrhoea brunonis*, *Hibbertia hypericoides* and *Synaphea petiolaris* (occasional) over a layer of herbs, grasses and sedges including *Agrostocrinum scabrum*, *Caesia micrantha*, *Austrostipa mollis*, *Cyathochaeta avenacea* and *Mesomelaena tetragona* with a varying admixture of exotic shrubs and herbs including **Acacia longifolia*, **Asparagus asparagoides*, **Sparaxis bulbifera*, **Watsonia meriana*, **Ehrharta calycina*, **Eragrostis brownii* and **Plantago lanceolata* on red-brown clay-loam.
EmAfMpCF	*Eucalyptus marginata-Agonis flexuosa-Melaleuca preissiana* closed forest	Closed forest of *Eucalyptus marginata* (scattered) over *Agonis flexuosa* and *Melaleuca preissiana* over open shrubland of *Acacia extensa, A. pulchella, Adenanthos meisneri*, *Astartea scoparia, Dasypogon bromeliifolius, Jacksonia furcellata* and *Xanthorrhoea brunonis* over open herbs and sedges including *Anarthria prolifera, Drosera menziesii* and *Opercularia hispidula* on grey-brown loamy sand
ErAfMpCF	*Eucalyptus rudis-Agonis flexuosa-Melaleuca preissiana* closed forest	Closed forest to open forest of *Eucalyptus rudis* (emergent) over *Agonis flexuosa*, *Calostachyus lanceolata* and *Melaleuca preissiana* over shrubland of *Astartea scoparia* and *Kunzea glabrescens* over herbland of *Pteridium esculentum* on grey sand with thick leaf litter.
Planted	Plantation of exotic eucalypts and other amenity species	

Table 13. Comparison of the Vegetation Units from the Project Area with FCTs described by Gibson et al. (1994) and Webb et al. (2009).

CODE	NAME	FLORISTIC COMMUNITY TYPE (Gibson *et al.*, 1994)	PLANT COMMUNITY (Webb *et al*., 2009)
AfMpLCF	*Agonis flexuosa-Melaleuca preissiana* low closed forest	Some similarities to *Melaleuca preissiana* Damplands (SCP 04) – however the presence of *Agonis flexuosa* as a co-dominant sets the Project Area vegetation unit apart.	Capel River Communities: the incised floodplain tends to support *Eucalyptus patens*, *Eucalyptus calophylla*, *Agonis flexuosa* and *Melaleuca preissiana*. ('Further survey work of the river vegetation is needed.')
AsHvMvTS	*Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland	Similarities to Dense shrublands on Clay Flats (SCP 9) which is a Threatened Ecological Community (Vulnerable).	
AsS	*Astartea scoparia* shrubland		Probably a degraded variant of AsHvMvTS or EmAfMpCF where it occurs north of Gavins Road. Appears to have been a result of disturbance associated with construction of the railway.
BaBiW	*Banksia attenuata-Banksia ilicifolia* woodland	Most similar to Southern *Banksia attenuata* Woodlands (SCP 21b) – Priority Ecological Community (Level 3)	
BaBiW_deg	*Banksia attenuata-Banksia ilicifolia* woodland (degraded)	A degraded variant of BaBiW	
CcMrCF	*Corymbia calophylla-(Eucalyptus rudis)-Melaleuca rhaphiophylla* closed forest	Some similarities to Wet Forests and Woodlands (SCP 11)	*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands) – Priority Ecological Community (Level 1)
CcXbOF	*Corymbia calophylla -Xanthorrhoea brunonis* open forest	No close matches, but most similar to *Corymbia calophylla-Xanthorrhoea preissii* Woodlands and Shrublands (SCP 3c) which is a Threatened Ecological Community (Critically Endangered).	
EmAfMpCF	*Eucalyptus marginata-Agonis flexuosa-Melaleuca preissiana* closed forest	Some similarities to Wet Forests and Woodlands (SCP 11)	*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands) – Priority Ecological Community (Level 1)
ErAfMpCF	*Eucalyptus rudis-Agonis flexuosa-Melaleuca preissiana* closed forest	Some similarities to Wet Forests and Woodlands (SCP 11)	*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands) – Priority Ecological Community (Level 1)

3.6 Vegetation Condition

Just under 25 ha of the 123 ha Project Area consists of remnant native vegetation or plantations of amenity trees, of which 21.6 ha comprises native vegetation in a range of condition classes. About 55% of the Project Area was classified as 'Completely Degraded' or 'Degraded' (**Table 14, Figure 13**). At the other end of the scale, 21.7% of the area was classed as 'Very Good to Excellent', with the bulk of this being in Crown Reserve 3249.

Table 14. Distribution of Vegetation Condition by Category within the Project Area.

Condition Score	Area (ha)	%
Completely Degraded	5.71	26.43
Degraded	6.43	29.80
Degraded/Good	1.35	6.26
Good	2.46	11.42
Good/Very Good	0.94	4.37
Very Good/Excellent	4.69	21.72
Totals	**21.59**	**100.00**

The main cause of degradation within the Project Area has been the invasion of aggressive weeds which have out-competed native species and caused a reduction in the species-richness of the remnant vegetation. Weed invasion has been facilitated by a long history of physical disturbance within much of the Project Area. A long history of livestock grazing is evident in the *Banksia* woodland remnants (outside of Crown Reserve 3249) where most of the native understorey species have consequently disappeared. *Phytophthora* dieback disease has also contributed to degradation within the *Banksia* woodland.

There has also been degradation of the remnant vegetation adjacent to the Dry Processing Plant on the railway reserve associated with a long history of physical disturbance.

3.7 *Phytophthora* dieback disease

The following general observations were made during the field survey in relation to *Phytophthora* dieback disease. The soil-borne pathogen *Phytophthora cinnamomi* is potentially present over a large portion of the Project Area due to the long history of soil movement and disturbance. However, it is likely that much of the Project Area would be mapped as 'Uninterpretable' because, mainly due to the effects of past grazing, many of the understorey species susceptible to *Phytophthora* are no longer present. Samples taken from recent deaths or dying plants are required in order to confirm presence or absence of the pathogen. However, because the pathogen has very likely been present for many years and therefore had its impact on the vegetation, there are unlikely to be new deaths resulting from it (except in Reserve 3249). While there is visual evidence that the disease is present on the SECWA easement adjacent to Nature Reserve 3249 and that this infestation is

spreading upslope, it does not appear to have infiltrated far into the Nature Reserve as yet. This is indicated by the high proportion of susceptible species still present in healthy condition. Also, if the disease is present within the CcXbOF community (inferred to be the TEC SCP3c) within the railway reserve, it does not appear to be causing significant impact. Studies have found (e.g. Shearer and Crane, 2011) that plant death related to *Phytophthora cinnamomi* disease is reduced, or inhibited, in fertile loams similar to those found in the railway reserve, and therefore has a reduced impact on native species occurring on these soils.

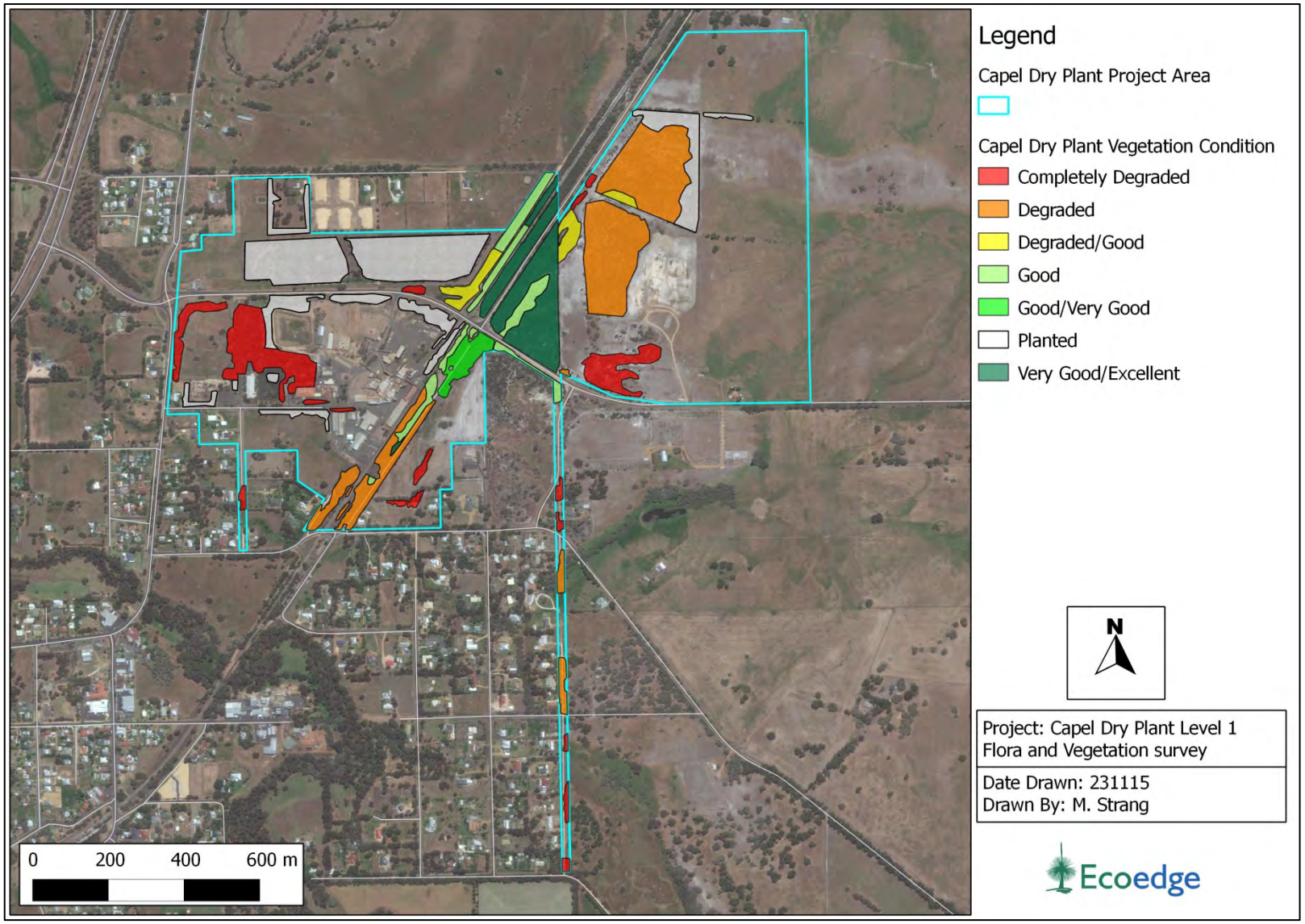

Figure 13. Condition of the vegetation within the Project Area.

3.9 Conservation Status of the Vegetation Units

3.9.1 *Corymbia calophylla -Xanthorrhoea brunonis* open forest (CcXbOF)

This vegetation unit is situated along the railway line immediately to the east and south east of the Capel Dry Plant. The soil within the area covered by this unit, instead of being Bassendean 'B1' ('deep bleached grey sands') as mapped for the area by Schoknecht *et al*. (2004) (**Table 1**, **Figure 2**, above), are actually red-brown clay-loam or brown clay typical of some Pinjarra Plain soil-types of alluvial origin. It appears that this part of the Project Area lies at the northern edge of the Capel River floodplain (the river itself is situated less than 400 m south of the southern part of the Project Area). Consistent with the clay-loam soil type, the vegetation is predominantly an open forest dominated by Marri (*Corymbia calophylla*) together with some Jarrah (*Eucalyptus marginata*).

Most of the approximately 1.8 ha of vegetation mapped as CcXbOF was assessed as in 'Degraded' condition (see Section 3.6, above) - only 1,550 m^2 or 8.65% of the total was assessed as 'Good' or 'Very Good – Excellent'. This community has been heavily invaded by exotic species, such as the bulb-forming **Sparaxis bulbifera* and **Watsonia meriana*, the grass **Eragrostis curvula*, the creeper **Asparagus asparagoides* and the small tree **Acacia longifolia*. Consequently, many of the native understorey species have disappeared. However, in the areas where the vegetation was rated as 'Good' or 'Very Good-Excellent' condition, sufficient of the understorey taxa remained that the floristic composition could be compared to the FCTs of Gibson *et al.* (1994).

A 100 m^2 floristic quadrat was marked out by metal stakes within the area of CcXbOF rated as "very good-excellent" condition and a species list made of the flora within it to assist with further analysis of the status of this community. A comparison of the species occurring within the CcXbOF vegetation unit with the two most likely Swan Coastal Plain Survey FCTs; *Corymbia calophylla-Xanthorrhoea preissii* Woodlands and Shrublands (SCP 3c) and Southern *Corymbia calophylla* Woodlands on Heavy Soils (SCP 1b) showed that it was closer to SCP 3c. The CcXbOF vegetation unit contains 12 out of the 22 'typical' and 'common' taxa (54.5%) of SCP 3c compared to 10 of the 38 'typical' and 'common' taxa (26.3%) of SCP 1b. Although the CcXbOF does not contain *Xanthorrhoea preissii*, one of the 'typical' species of SCP 3c, the two closest listed occurrences of this FCT to the Project Area (along Boyanup-Capel Road and Boyanup West Road) also contain *X. brunonis* rather than *X. preissii* (DEC, 2007).

In summary, there is about 1.8 ha of vegetation unit CcXbOF adjacent to the Capel Dry Plant. While much of this was classed as 'Degraded' and many of the native understorey species having been replaced by weeds, 0.15 ha was in 'Good' or 'Very Good-Excellent' condition. While this is only a small proportion of the total area of the vegetation unit, it is considered to have high conservation value because it is inferred to be a new occurrence of the Critically Endangered Threatened Ecological Community *Corymbia calophylla-Xanthorrhoea*

preissii Woodlands and Shrublands (SCP 3c). The remainder of vegetation unit CcXbOF categorised as 'Degraded' condition is not considered belong to the Threatened Ecological Community SCP 3c because most of the native understorey species have been replaced by exotic species.

3.9.2 *Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland (AsHvMvTS)

As noted in **Table 13**, this vegetation unit has similarities to the FCT 'Dense shrublands on Clay Flats (SCP 9)' which is a Threatened Ecological Community with the risk status of 'Vulnerable'. Most of this unit was classed as 'Degraded' with much of the ground layer occupied by weeds such as **Watsonia meriana*, or almost bare of a ground layer. Just over 20% of this vegetation unit was assessed as 'Good'. Further assessment may be required to establish whether the part of this vegetation unit that is in 'Good' condition also constitutes an occurrence of a TEC.

3.9.3 Priority Ecological Communities in Crown Reserve 3249

It is inferred that the vegetation units AfMpLCF, CcMrCF, EmAfMpCF and ErAfMpCF within the Project Area represent examples of the Priority 1 Ecological Community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands)'. Almost all of the area of these communities was assessed as 'Good' or 'Very Good/Excellent' condition. Consultation with DPaW may be required to resolve the status of these communities.

4 Discussion and Conclusions

A spring flora survey of the Project Area identified two hundred and fourteen taxa of vascular flora, of which 54 (25.2%) were exotic species. The total of at least 160 native species in just over 20 ha of native vegetation represents a relatively high level of diversity (R. Smith, unpublished data) and may be ascribed to the number of different habitat types present within the Project Area.

The plants comprising the two recorded sub-populations of the DRF species *Drakaea elastica* were not found during the current survey and they may be extinct. However, the presence of these two sub-population records will need to be taken into account with regard to any proposed works by Iluka that involve ground disturbance.

The location of the populations of priority species within Crown Reserve 3249 found during the survey (*Caladenia speciosa*, *Stylidium paludicola* and *Acacia semitrullata*) also need to be taken into account if any ground disturbance is planned within their vicinity.

Ten vegetation units dominated by native trees or shrubs were identified within the Project Area. One of these units (Cc/Er_pasture) was (by definition) classified as 'Completely Degraded' throughout. The species composition of the other nine vegetation units was compared to the FCTs defined by Gibson *et al*. (1994) for the southern Swan Coastal Plain,

or if there was not a close match with any of these, to the communities described by Webb *et al*. (2009).

One of the vegetation units, *Corymbia calophylla-Xanthorrhoea brunonis* open forest (CcXbOF), had its closest match with and is therefore inferred as the Critically Endangered TEC *Corymbia calophylla-Xanthorrhoea preissii* Woodlands and Shrublands (SCP 3c). Although CcXbOF contains just over half of the 'typical' and 'other common' species listed for the TEC SCP 3c, its position at the southernmost end of the range for that TEC could be posited as the reason for this difference. In particular, a strong case can be made that the 470 m^2 of this vegetation unit that was rated as 'Very Good-Excellent' condition is a new occurrence of SCP 3c.

Another vegetation unit, *Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland (AsHvMvTS), which occurs on brown clays immediately adjacent to the Dry Processing Plant, also resembles a TEC, in this case 'Dense shrublands on Clay Flats (SCP 9), which is rated as 'Vulnerable'. However most of this community was classed as 'Degraded', with only about 20% being rated as 'Good' condition. Because of the generally poor condition of this vegetation unit (and its relatively low species-richness), the case for it being proposed as a new occurrence of the TEC SCP 9 is not as strong as that for the *Corymbia calophylla-Xanthorrhoea brunonis* open forest community. Advice from DPaW may be required to make a determination about its status.

Four vegetation units within the Project Area (AfMpLCF, CcMrCF, EmAfMpCF and ErAfMpCF) are inferred as examples of the Priority 1 Ecological Community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (of Spearwood Dune Wetlands)'. Generally the condition of these communities is very good.

5 Recommendations

- Vegetation along the railway line within the Project Area links in the southwest to vegetation along the Capel River and in the north with vegetation in Nature Reserve 3249 and along the road reserve and railway line along Capel-Boyanup Road, eventually linking to State Forest 27 east of Boyanup. As such, it is recommended that where feasible, vegetation categorised as '1a' or '1b' be retained, so as to minimise the loss of linkage value as much as is possible.

- Care should be exercised during any activities undertaken within parts of the CcXbOF vegetation unit (inferred to be the Critically Endangered TEC *Corymbia calophylla-Xanthorrhoea preissii* Woodlands and Shrublands (SCP 3c)), and particularly the area rated as 'Very Good – Excellent', so that the conservation status of this plant community is maintained. The same also applies to the four vegetation units within the Project Area that are inferred to be examples of the Priority 1 Ecological Community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low

Forest (of Spearwood Dune Wetlands)' (AfMpLCF, CcMrCF, EmAfMpCF and ErAfMpCF), and to the vegetation unit *Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland (AsHvMvTS).

- The vegetation unit *Acacia saligna-Hakea varia-Melaleuca viminea* tall shrubland (AsHvMvTS) has similarities to the FCT 'Dense shrublands on Clay Flats (SCP 9)' which is a Threatened Ecological Community with the risk status of 'Vulnerable'. Most of this unit was classed as 'Degraded', however just over 20% of this vegetation unit was assessed as 'Good'. Further assessment may be required to establish whether the part of this vegetation unit that is in 'Good' condition also constitutes an occurrence of a TEC.

- Consultation with DPaW is recommended to resolve the status of the vegetation communities inferred as occurrences of TECs and/or PECs.

- It is recommended that a *Phytophthora* dieback assessment be undertaken before any works involving the movement of soil or plant material are carried out.

6 References

(Not necessarily cited)

Australian Government (2009), *Interim Biogeographic Regionalisation of Australia (IBRA) Version 6.1*, Department of the Environment, Water, Heritage and the Arts. Retrieved January 2011 from http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html

Barnesby, B.A. and Proulx-Nixon, M.E. (2000). Land resources from Harvey to Capel on the Swan Coastal Plain, Western Australia – Sheets 1 & 2. Land Resources Map 23/2. Agriculture Western Australia.

Carstairs, S. and Coates, D. (1994) Conservation Genetics and Population Ecology of Five Rare and Threatened Western Australian Orchids. Final Report to the Western Australian Department of Conservation and Land Management, and Australian Nature Conservation Agency. (Cited in Department of Conservation and Environment, 2009).

Commonwealth of Australia (2001) *National Objectives and Targets for Biodiversity Conservation 2001-2005.* Environment Australia, Department of Environment and Heritage, Canberra, Australian Capital Territory.

Bureau of Meteorology (BOM). (2015). State of the Climate 2014. http://www.bom.gov.au/state-of-the-climate/

Cropper, S.C. (1993). Management of endangered plants. CSIRO, Melbourne.

Department of Agriculture and Food (DAF) (2007). *Biosecurity and Agriculture Management Act 2007*. Perth Western Australia

Department of Agriculture and Food (DAF). 2014. Declared plants. *https://www.agric.wa.gov.au/pests-weeds-diseases/weeds/declared-plants*

Department of Environment and Conservation (2009). Glossy-leafed Hammer Orchid (*Drakaea elastica*) Recovery Plan. Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (DEC) (2007). New occurrences of *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands (SCP3c) in South West region (Including Nomination of New Occurrence forms). Unpublished reports, Bunbury Office.

Department of Environment and Conservation (DEC) (2010) *Definitions, categories and criteria for threatened and priority ecological communities.* Department of Environment and Conservation, Perth, Western

Australia. http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/tecs/tec-definitions-dec2010.pdf

Department of Environment, Water, Heritage and the Arts (DEWHA) (1999) *Environment Protection and Biodiversity Conservation Act 1999*. Department of Environment, Water, Heritage and the Arts. Canberra, Australian Capital Territory

Department of Parks and Wildlife (DPaW) (2014). *Conservation Codes for Western Australian Flora and fauna.* http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions.pdf

Department of Parks and Wildlife (DPaW) (2015a). *Threatened ecological communities endorsed by the Minister for the Environment* (June 2015). http://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2015.pdf

Department of Parks and Wildlife (DPaW) (2015b). *Priority ecological communities list* (June 2015). Department of Parks and Wildlife. http://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2015.pdf

Department of Parks and Wildlife (DPaW) (2015c). *NatureMap*, Western Australian Herbarium. http://naturemap.dec.wa.gov.au/default.aspx. Accessed 15 September 2015

Department of Parks and Wildlife (DPaW) (2015d). The WA Herbarium Census of WA Plants Database (WACENSUS: 'Max' update 13/07/2015).

Department of Parks and Wildlife (DPaW) (2015e). *Florabase*, Western Australian Herbarium.

Department of the Environment. (DotE) (2015a). *Threatened ecological communities under the EPBC Act*. http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl Accessed 28 August 2015

Department of the Environment. (DotE) (2015b). *Protected Matters Search Tool query*. Generated 9 September 2015

Department of the Environment. (DotE) (2015c). *Categories of Threatened species under the EPBC Act*. http://www.environment.gov.au/biodiversity/threatened/species.html Accessed 24 September 2015

Department of the Environment. (DotE) (2015d). *Environment Protection and Biodiversity Conservation Act. Species Profile and Threats*

Database. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl accessed 26 August 2015

Department of the Environment. (2015). National recovery plan for the Glossy-leafed Hammer Orchid (*Drakaea elastica*). https://www.environment.gov.au/resource/national-recovery-plan-glossy-leafed-hammer-orchid-drakaea-elastica

Environment Australia (2001). *National objectives and targets for biodiversity conservation 2001–2005. http://www.environment.gov.au/resource/national-objectives-and-targets-biodiversity-conservation-2001%E2%80%932005*

Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2.* EPA, Perth

Environmental Protection Authority of WA (2004). *Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 51*.

Environmental Protection Authority (2006). *Level of Assessment for Proposals affecting Natural Area within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region*. Guidance Statement No. 10, June 2006, Perth.

Environmental Protection Authority of WA (EPA). (2009). *South West Regional Ecological Linkages. Environmental protection Bulletin No. 8*. EPA, Perth, Western Australia

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). A floristic survey of the southern Swan Coastal Plain: report to Heritage Council of W.A. and Australian Heritage Commission. Department of Conservation and Land Management, Western Australia.

Government of Western Australia (1950). Wildlife Conservation Act 1950. Perth, Western Australia

Government of Western Australia (2000). *Bush Forever. Volume 2. Directory of Bush Forever Sites*. Government of Western Australia.

Government of Western Australia (2005). Environmental Protection (Environmentally Sensitive Areas) Notice 2005 (Environmental Protection Act 1986). Government Gazette, No.55

Government of Western Australia. (2013a). *2012 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of October 2012*. WA Department of Environment and Conservation. Perth, Western Australia. https://www2.landgate.wa.gov.au/web/guest/downloader

Government of Western Australia (2013b). *Wildlife Conservation Act 1950, Wildlife Conservation (Rare Flora) Notice 2013*. Government Gazette, 17 September 2013.

Havel, J.J. and Mattiske, E.M. (2000). *Vegetation mapping of south west forest regions of Western Australia*. *Parts 6 and 7 (Maps).* CALMScience Division, Australia. Environment Australia

Hoffman, N. and Brown, A. (2011). *Orchids of South – West Australia*. Third Edition Noel Hoffman. Gooseberry Hill, Western Australia.

Keighery, B. J. (1994). *Bushland Plant Survey: A guide to plant community survey for the community*. Wildflower Society of Western Australia (Inc.), Nedlands

Mattiske, E.M. and Havel, J.J., 1998. *Vegetation Complexes of the South-west Forest Region of Western Australia. Maps and report prepared as part of the Regional Forest Agreement*. Western Australia for the Department of Conservation and Land Management and Environment Australia. Western Australia.

Mattiske Consulting (2009). Flora and Vegetation Survey of Capel Dry Plant Project Area. Unpublished report prepared for Iluka Resources Ltd.

Molloy, S., O'Connor, T., Wood, J. and Wallrodt, S. (2009). South West Regional Ecological Linkages Technical Report. Western Australian Local Government Association (WALGA) and the Department of Environment and Conservation (DEC). West Perth.

Schoknecht, N., Tille, P., Purdie, B. (2004). Soil Landscape Mapping in South-Western Australia – Overview of Methodology and Outputs – Resource Management Technical Report 280. Department of Agriculture, Government of Western Australia.

Shearer B.L. and Crane C.E. (2011). *Habitat suitability of soils from a topographic gradient across the Fitzgerald River National Park for invasion by Phytophthora cinnamomi*. Australasian Plant Pathology 40, pp. 168–179

Smith, R.S. (2007). A Preliminary Analysis of Floristic Quadrat Data from the Eastern Part of the South West Region (The Darkan-Boyup Brook Survey). Unpublished report, Department of Environment and Conservation, Bunbury, Western Australia, 25 pp.

Webb, A, Keighery, B.J., Keighery, G.J., Longman, V. (2009). The flora and vegetation of the Busselton Plain (Swan Coastal Plain): a report for the Department of Environment and Conservation as part of the Swan Bioplan Project. Dept. of Environment and Conservation, Perth, Western Australia.

Wege, J. (2014). An account of the reed triggerplants (*Stylidium* sect. Junceae: Stylidiaceae). Nuytsia, Vol. 24: 215-247.

Appendix 1. Protected Matters Search Tool Report

Australian Government

Department of the Environment

EPBC Act Protected Matters Report

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

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

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

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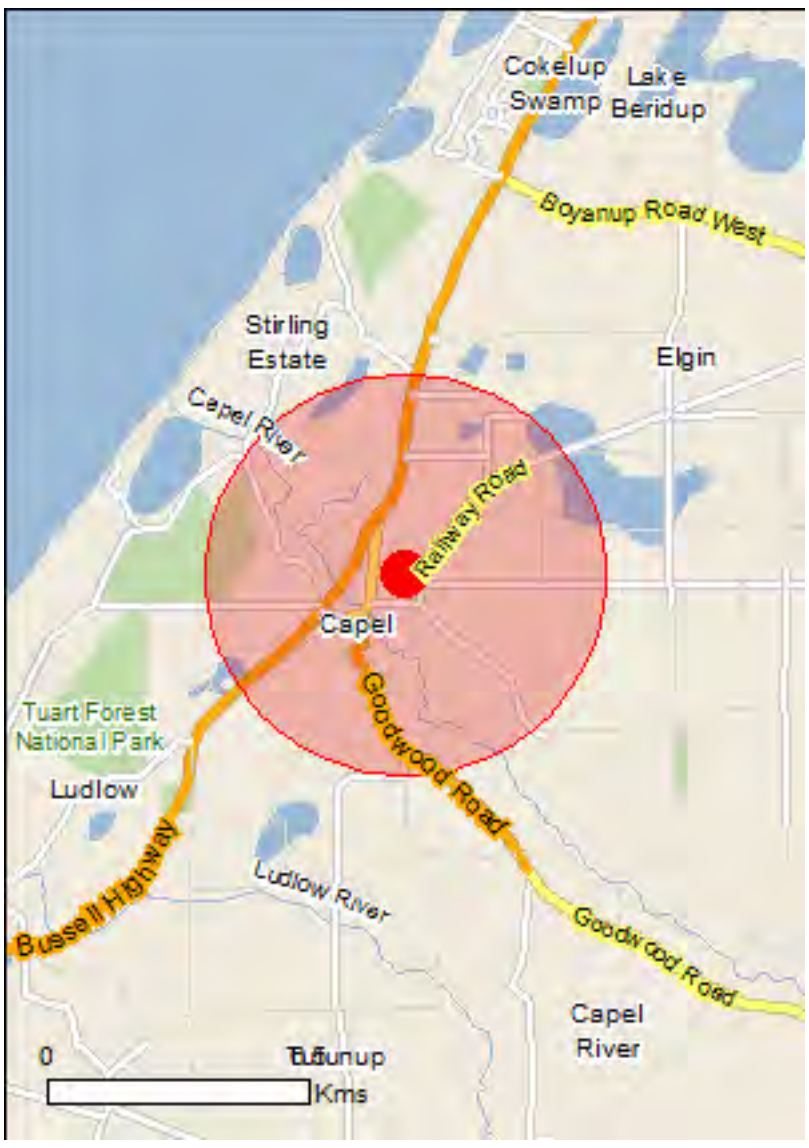

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

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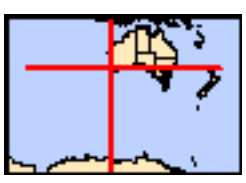

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	26
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	26
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Vasse-wonnerup system	Within 10km of Ramsar

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Breeding known to occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Brachyscias verecundus		
Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat may occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. C Coastal Plain (R.D.Royce 4872) Royce's Waxflower [86887]	Vulnerable	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Capel	WA
Tuart Forest	WA
Unnamed WA03249	WA
Unnamed WA50190	WA

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.54517 115.57243

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

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

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix 2. List of vascular flora found within the Project Area at Capel.

FAMILY	SPECIES	NATURALISED	CONSV. CODE
Anarthriaceae	*Anarthria prolifera*		
	Lyginia barbata		
Apiaceae	*Centella asiatica*		
	Zantedeschia aethiopica	*	
Araliaceae	*Trachymene pilosa*		
Asparagaceae	*Asparagus asparagoides*		
	Chamaescilla corymbosa		
	Lomandra purpurea		
	Thysanotus dichotomus		
	Thysanotus manglesianus		
	Thysanotus tenellus		
Asphodelaceae	*Aloe vera*	*	
Asteraceae	*Arctotheca calendula*	*	
	Carduus tenuiflorus	*	
	Conyza bonariensis	*	
	Cotula turbinata	*	
	Dittrichia graveolens	*	
	Hypochaeris glabra	*	
	Lagenophora huegelii		
	Rhodanthe citrina		
	Sonchus oleraceus	*	
	Ursinia anthemoides	*	
Boryaceae	*Borya scirpoidea*		
Brassicaceae	*Raphanus raphanistrum*	*	
Caryophyllaceae	*Stellaria media*	*	
Casuarinaceae	*Allocasuarina humilis*		
Centrolepidaceae	*Aphelia drummondii*		
Colchicaceae	*Burchardia congesta*		
Cyperaceae	*Baumea vaginalis*		
	Chorizandra enodis		
	Cyathochaeta avenacea		
	Cyperus eragrostis	*	
	Ficinia nodosa		
	Lepidosperma longitudinale		
	Lepidosperma pubisquameum		
	Lepidosperma squamatum		
	Mesomelaena tetragona		
	Schoenus bifidus		
	Schoenus curvifolius		
	Schoenus efoliatus		
	Schoenus rigens		
	Schoenus subbulbosus		
	Tetraria octandra		
Dasypogonaceae	*Dasypogon bromeliifolius*		

FAMILY	SPECIES	NATURALISED	CONSV. CODE
Dennstaedtiaceae	*Pteridium esculentum*		
Dilleniaceae	*Hibbertia cuneiformis*		
	Hibbertia diamesogenos		
	Hibbertia hypericoides		
	Hibbertia racemosa		
	Hibbertia vaginata		
Droseraceae	*Drosera bulbigena*		
	Drosera erythrorhiza		
	Drosera menziesii subsp. *penicillaris*		
	Drosera pallida		
Ericaceae	*Conostephium pendulum*		
	Leucopogon australis		
	Leucopogon glabellus		
Fabaceae	*Acacia applanata*		
	Acacia dealbata	*	
	Acacia extensa		
	Acacia iteaphylla	*	
	Acacia longifolia	*	
	Acacia microbotrya		
	Acacia podalyriifolia	*	
	Acacia pulchella var. *pulchella*		
	Acacia saligna		
	Acacia semitrullata		4
	Acacia stenoptera		
	Callistachys lanceolata		
	Daviesia angulata		
	Daviesia physodes		
	Daviesia preissii		
	Eutaxia virgata		
	Gastrolobium capitatum		
	Gastrolobium ebracteolatum		
	Gompholobium marginatum		
	Gompholobium tomentosum		
	Hardenbergia comptoniana		
	Hovea trisperma		
	Jacksonia furcellata		
	Jacksonia horrida		
	Kennedia prostrata		
	Ornithopus compressus	*	
	Ornithopus pinnatus	*	
	Trifolium dubium	*	
	Viminaria juncea		
Geraniaceae	*Erodium botrys*	*	
	Geranium dissectum	*	
	Pelargonium capitatum	*	

FAMILY	SPECIES	NATURALISED	CONSV. CODE
Goodeniaceae	*Dampiera linearis*		
Goodeniaceae	*Scaevola calliptera*		
Haemodoraceae	*Anigozanthos manglesii*		
	Conostylis aculeata subsp. *aculeata*		
	Haemodorum laxum		
	Haemodorum simplex		
	Haemodorum spicatum		
	Phlebocarya ciliata		
Hemerocallidaceae	*Agrostocrinum scabrum*		
	Caesia micrantha		
	Johnsonia lupulina		
	Stypandra glauca		
Iridaceae	*Babiana angustifolia*	*	
	Gladiolus angustus	*	
	Patersonia occidentalis		
	Romulea rosea	*	
	Sparaxis bulbifera	*	
	Sparaxis pillansii	*	
	Watsonia meriana var. *bulbillifera*	*	
	Iridaceae sp.	*	
Juncaceae	*Juncus holoschoenus*		
	Juncus microcephalus	*	
	Juncus pallidus		
Lamiaceae	*Hemiandra pungens*		
Lauraceae	*Cassytha glabella*		
Lentibulariaceae	*Utricularia multifida*		
Loranthaceae	*Nuytsia floribunda*		
Menyanthaceae	*Ornduffia parnassifolia*		
Moraceae	*Ficus carica*	*	
Myrtaceae	*Agonis flexuosa*		
	Astartea scoparia		
	Babingtonia camphorosmae		
	Calytrix flavescens		
	Corymbia calophylla		
	Eucalyptus globulus	*	
	Eucalyptus gomphocephala		
	Eucalyptus marginata		
	Eucalyptus rudis subsp. *cratyantha*		4
	Hypocalymma robustum		
	Kunzea glabrescens		
	Leptospermum laevigatum	*	
	Melaleuca incana		
	Melaleuca preissiana		
	Melaleuca rhaphiophylla		
	Melaleuca thymoides		

FAMILY	SPECIES	NATURALISED	CONSV. CODE
Myrtaceae	*Melaleuca viminea*		
	Pericalymma ellipticum var. *ellipticum*		
	Taxandria linearifolia		
Onagraceae	*Oenothera glazioviana*	*	
Orchidaceae	*Caladenia flava*		
	Caladenia latifolia		
	Caladenia speciosa		4
	Diuris brumalis		
	Elythranthera brunonis		
	Microtis media		
	Pterostylis recurva		
	Pterostylis sp. crinkled leaf (G.J. Keighery 13426)		
	Pterostylis vittata		
	Pyrorchis nigricans		
	Thelymitra antennifera		
	Thelymitra cornicina		
	Thelymitra macrophylla		
Oxalidaceae	*Oxalis glabra*	*	
	Oxalis pes-caprae	*	
Papaveraceae	*Fumaria bastardii*	*	
	Fumaria capreolata	*	
Philydraceae	*Philydrella drummondii*		
Phyllanthaceae	*Phyllanthus calycinus*		
Pittosporaceae	*Billardiera variifolia*		
Plantaginaceae	*Plantago lanceolata*	*	
Poaceae	*Amphipogon turbinatus*		
	Austrostipa campylachne		
	Austrostipa compressa		
	Austrostipa mollis		
	Avena fatua	*	
	Briza maxima	*	
	Bromus diandrus	*	
	Cenchrus clandestinus	*	
	Cortaderia selloana	*	
	Cynodon dactylon	*	
	Ehrharta calycina	*	
	Ehrharta longiflora	*	
	Eragrostis curvula	*	
	Holcus lanatus	*	
	Microlaena stipoides		
	Neurachne alopecuroidea		
	Paspalum dilatatum	*	
	Tetrarrhena laevis		
Polygonaceae	*Rumex conglomeratus*	*	

FAMILY	SPECIES	NATURALISED	CONSV. CODE
Proteaceae	*Adenanthos meisneri*		
	Adenanthos obovatus		
	Banksia attenuata		
	Banksia dallanneyi		
	Banksia ilicifolia		
	Banksia littoralis		
	Hakea lissocarpha		
	Hakea prostrata		
	Hakea varia		
	Persoonia longifolia		
	Petrophile linearis		
	Stirlingia latifolia		
	Synaphea petiolaris subsp. *petiolaris*		
	Xylomelum occidentale		
Ranunculaceae	*Ranunculus muricatus*	*	
Restionaceae	*Harperia lateriflora*		
	Hypolaena exsulca		
	Meeboldina coangustata		
	Meeboldina roycei		
	Stenotalis ramosissima		
Rhamnaceae	*Spyridium globulosum*		
Rubiaceae	*Opercularia apiciflora*		
	Opercularia hispidula		
Rutaceae	*Philotheca spicata*		
Solanaceae	*Solanum nigrum*	*	
Stylidiaceae	*Stylidium androsaceum*		
	Stylidium brunonianum		
	Stylidium paludicola		3
	Stylidium repens		
	Stylidium schoenoides		
Xanthorrhoeaceae	*Xanthorrhoea brunonis*		
	Xanthorrhoea gracilis		
	Xanthorrhoea preissii		
Zamiaceae	*Macrozamia riedlei*		

Appendix 3. Species x vegetation unit matrix

VEGETATION UNIT	AfMpLCF	AsHvMvTS	AsS	BaBiW	BaBiW_deg	CcMrCF	CcXbOF	EmAfMpCF	ErAfMpCF
Acacia extensa	1							1	1
Acacia pulchella var. *pulchella*				1	1			1	1
Acacia saligna		1	1		1	1	1		
Acacia stenoptera			1			1			
Adenanthos meisneri				1				1	
Agonis flexuosa	1							1	1
Agrostocrinum scabrum							1	1	
Allocasuarina humilis				1					
Anarthria prolifera								1	
Anigozanthos manglesii				1					
Astartea scoparia	1	1	1			1	1	1	1
Astroloma ciliatum							1		
Austrostipa mollis							1		
Babingtonia camphorosmae							1		
Banksia attenuata				1	1				
Banksia dallanneyi							1		
Banksia ilicifolia				1	1				
Banksia littoralis						1			
Baumea vaginalis						1		1	
Burchardia congesta				1	1				
Caesia micrantha		1					1		
Caladenia flava									1
Caladenia latifolia									1
Callistachys lanceolata									1
Calytrix flavescens					1				
Chamaescilla corymbosa	1								
Conostephium pendulum				1					
Conostylis aculeata subsp. *aculeata*					1				
Corymbia calophylla	1					1	1	1	

VEGETATION UNIT	AfMpLCF	AsHvMvTS	AsS	BaBiW	BaBiW_deg	CcMrCF	CcXbOF	EmAfMpCF	ErAfMpCF
Cyathochaeta avenacea						1	1		
Dampiera linearis		1				1	1	1	
Dasypogon bromeliifolius	1			1	1			1	
Daviesia preissii							1		
Drosera erythrorhiza				1				1	
Drosera menziesii subsp. *penicillaris*								1	
Drosera pallida								1	
Elythranthera brunonis				1	1				
Eucalyptus marginata				1	1		1	1	
Eucalyptus rudis						1		1	1
Ficinia nodosa						1			
Gladiolus angustus							1		
Gompholobium marginatum							1		
Haemodorum laxum							1		
Haemodorum spicatum	1								
Hakea varia		1				1	1		
Hardenbergia comptoniana					1			1	1
Hemiandra pungens				1	1				
Hibbertia cuneiformis	1								
Hibbertia hypericoides				1	1		1		
Hibbertia vaginata				1					
Hovea trisperma								1	
Hypocalymma robustum				1					
Hypolaena exsulca				1					
Jacksonia furcellata								1	
Juncus pallidus	1					1			
Kennedia prostrata									1
Kunzea glabrescens				1	1			1	1
Lepidosperma longitudinale	1					1			1
Lepidosperma pubisquameum							1		
Leucopogon australis	1								

VEGETATION UNIT	AfMpLCF	AsHvMvTS	AsS	BaBiW	BaBiW_deg	CcMrCF	CcXbOF	EmAfMpCF	ErAfMpCF
Lyginia barbata	1				1				
Macrozamia riedlei				1	1				
Meeboldina roycei			1						1
Melaleuca preissiana	1		1					1	1
Melaleuca rhaphiophylla						1			
Melaleuca thymoides				1				1	
Melaleuca viminea		1					1		
Mesomelaena tetragona		1					1		
Microlaena stipoides	1								
Neurachne alopecuroidea							1		
Nuytsia floribunda							1	1	
Opercularia apiciflora							1		
Opercularia hispidula						1		1	
Ornduffia parnassifolia						1			
Patersonia occidentalis		1		1		1	1		
Philotheca spicata								1	
Phlebocarya ciliata					1			1	
Phyllanthus calycinus							1		
Pteridium esculentum					1	1		1	1
Pterostylis sp. crinkled leaf (G.J. Keighery 13426)								1	
Pterostylis vittata	1			1					
Pyrorchis nigricans				1					
Scaevola calliptera						1		1	
Sparaxis bulbifera		1					1		
Stirlingia latifolia				1	1				
Stypandra glauca							1		
Synaphea petiolaris subsp. *petiolaris*	1		1				1		
Taxandria linearifolia						1			1
Tetraria octandra							1		
Tetrarrhena laevis	1								
Thelymitra cornicina							1		

VEGETATION UNIT	AfMpLCF	AsHvMvTS	AsS	BaBiW	BaBiW_deg	CcMrCF	CcXbOF	EmAfMpCF	ErAfMpCF
Utricularia multifida		1							
Viminaria juncea		1	1			1			
Xanthorrhoea brunonis							1	1	
Xanthorrhoea gracilis	1						1		
Xylomelum occidentale				1	1				

Appendix 4. Photographs of Vegetation Units in the Capel Dry Plant Project Area

Agonis flexuosa-Melaleuca preissiana low closed forest (AfMpLCF)

Acacia saligna-Hakea varia-Melaleuca viminea tall shrubland (AsHvMvTS)

Astartea scoparia shrubland (AsS)

Banksia attenuata-Banksia ilicifolia woodland (BaBiW)

Banksia attenuata-Banksia ilicifolia woodland (degraded) (BaBiW_deg)

Corymbia calophylla-(Eucalyptus rudis)-Melaleuca rhaphiophylla closed forest (CcMrCF)

Corymbia calophylla -Xanthorrhoea brunonis open forest (CcXbOF) – Very Good-Excellent condition

Corymbia calophylla -Xanthorrhoea brunonis open forest (CcXbOF) – Degraded condition

Eucalyptus marginata-Agonis flexuosa-Melaleuca preissiana closed forest (EmAfMpCF)

Eucalyptus rudis-Agonis flexuosa-Melaleuca preissiana closed forest (ErAfMpCF)

Appendix B Fauna Survey, Capel Dry Plant (Harewood 2018)

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Fauna Assessment

Capel Dry Plant

May 2018
V4

On behalf of:
Iluka Resources Limited
140 St Georges Terrace
PERTH WA 6000

Prepared by:
Greg Harewood
Zoologist
PO Box 755
BUNBURY WA 6231
M: 0402 141 197
E: gharewood@iinet.net.au

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SUMMARY

This report details the results of a fauna assessment of an area of land at Iluka Resources Limited's Capel Dry Plant (CDP; the subject site). The subject site has a total area of about 7.0 hectares and is comprised of a combination of car parks, buildings, completely degraded grasslands and native woodland over pasture or weeds, planted endemic and non-endemic trees and shrubs, and an artificial wetland.

The scope of works was to conduct a Level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2016). Because some listed threatened species (i.e. black cockatoos and western ringtail possums (WRPs)) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site's significance to these particular species. The assessment has included a literature review ("desktop study") and a series of field surveys (day and night) carried out in December 2017 and March 2018.

The subject site itself is highly degraded and with the exception of some scattered/groves of marri (*Corymbia calophylla*) and flooded gum (*Eucalyptus rudis*) and contains only a small percentage of native vegetation.

The northern section of the subject site contains a decommissioned by-product dam with some limited regrowth in a central high point. The by-product dam is bordered by a grassland of introduced species with some areas of highly degraded open woodland of marri, flooded gum and/or planted non-endemic eucalyptus. The western most portion of the subject site contains a paddock area with widely scattered trees.

The southern half of the subject site contains an artificial lake into which process water was historically pumped. The lake has some open water though most areas are covered with a dense *Typha orientalis* reed bed. The lake is bordered mainly by planted endemic and non-endemic eucalyptus trees and shrubs with some marri, flooded gum, peppermint (*Agonis flexuosa*), tuart (*Eucalyptus gomphocephala*) and paperbark (*Melaleuca* sp.) also being present. A small grove of paperbark, marri and flooded gum covers a section of the subject site in its south west corner.

The subject site also contains two buildings in its southern section and these are also bordered in part by planted vegetation including endemic and non-endemic eucalyptus trees and various shrubs. The balance of the site contains carparks.

Overall fauna habitat quality is poor as a result of the sites high degree of historical disturbance. This coupled with the fact that the area is relatively small and isolated would suggest that the original biodiversity of the subject site has been significantly reduced from its original levels with only a fraction of the original fauna assemblage likely to occur.

A total of 27 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the day and night time surveys. One introduced species was also confirmed as being present.

The black cockatoo habitat assessment identified 55 trees within the subject site with a Diameter at Breast height (DBH) of ≥50 cm. The majority of the trees (49) appeared to contain no hollows of any size, a consequence of their relatively young age. It is assumed that these trees have either been planted (tuarts and non-endemic species) or represent regrowth (mostly marri) after a clearing event.

Two trees (2, ~3.6%) were identified as potentially containing hollows that appeared possibly big enough to allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk though conclusive evidence of actual use by black cockatoos was not seen. It should be noted that these trees are unlikely to fall within the proposed works footprint and therefore will not be directly impacted on.

The 16 unidentified non-endemic eucalypt trees making up the total were represented by at least two presumed eastern states species. It is not known if these tree species have the propensity to develop hollows suitable for black cockatoos.

Foraging evidence left by two species of black cockatoos within the subject site was observed. This foraging evidence was in the form of chewed marri fruits and was attributed to the Forest Red-tailed black cockatoo and Baudin's cockatoo depending on the nature of the marks left on discarded fruits. Marri woodland makes up about 1.2 ha of the subject site. No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

Thirteen WRP dreys were observed within the subject site during the day surveys. Eight WRPs and three common brushtail possums were recorded within a section of the subject site during the first nocturnal survey. Six WRPs and one common brushtail possum were recorded within a section of the subject site during the second nocturnal survey.

By combining the two nocturnal survey results, which were carried out over largely different areas, but excluding likely recounts, it is estimated that the subject site is currently being utilised by at least ten WRPs.

Based on the observations made, the majority of the vegetation (natural and planted) within the subject site represents WRP habitat of some type (i.e. refuge, foraging and/or dispersal). The area of planted vegetation with a dense midstorey component surrounding the artificial lake and administration building in the southern half of the subject site would appear to be the best quality area given it is characterised by a coherent canopy structure, provides good drey building opportunities and contains the widest variety of potential food sources.

In summary three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period:

- Baudin's cockatoo – Endangered (WA/Federal)
- forest red-tailed black cockatoo – Vulnerable (WA/Federal)
- WRP – Critically Endangered (WA), Vulnerable (Federal).

An additional three species of conservation significance may also utilise the subject site, though, as no evidence of these species presence was identified during the field survey, the status of some in the area remains uncertain. These are:

- Carnaby's cockatoo – Endangered (WA/Federal)
- peregrine falcon – Schedule 7 (WA)
- quenda – Priority 4 (WA).

1. INTRODUCTION

This report details the result of a fauna assessment of the Capel Dry Plant (CDP). The CDP site (subject site) is located within the town of Capel (Figure 1). The subject site has a total area of about 7.0 hectares (ha) and is comprised of a combination of car parks, buildings, completely degraded grasslands and native woodland over pasture or weeds, planted endemic and non-endemic trees and shrubs and an artificial wetland (Figure 2).

This fauna assessment represents one of several technical reports that will be used to provide an understanding of the suite of environmental values present within the subject site to assist with further planning.

It should be noted that field survey work at the subject site was completed in two phases after the area requiring assessment was expanded subsequent to the completion of the first phase.

2. SCOPE OF WORKS

The scope of works was to conduct a Level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2016). Because the general area is known to be utilised by black cockatoos and western ringtail possums (WRP) the scope of the survey work was expanded to include a baseline assessment of the sites significance to these species as well. The fauna assessment has therefore included:

1. Level 1 fauna assessment (in accordance with EPA (2016) guidelines);
2. Targeted searches for black cockatoo habitat/site use (habitat trees, existing and potential nest hollows, foraging and roosting habitat);
3. Targeted day and night searches for WRP habitat/site use (foraging, refuge and dispersal habitat and individuals); and
4. Report summarising results, methods.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's Cockatoo *(Calyptorhynchus baudinii*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

3. METHODS

3.1 POTENTIAL FAUNA INVENTORY - LITERATURE REVIEW

3.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of vertebrate fauna potentially occurring within the subject site:

- Department of Biodiversity, Conservation and Attractions' (DBCA) NatureMap database search (combined data from DBCA, WAM, BA, ALA and consultant's reports) (DBCA 2018b); and

- Department of Environment and Energy's (DotEE) Protected matters search tool (DotEE 2018).

It should be noted that lists produced during the abovementioned database searches contain observations/inferred distributions from a broader area than the subject site and therefore may include species that would only ever occur as vagrants due to a lack of suitable habitat or the presence of only marginal habitat within the subject site itself. The databases also often include or are based on very old records and in some cases certain fauna species have become locally or regionally extinct.

Information from these sources is therefore taken as indicative only and local knowledge and information is taken into consideration when determining what actual species may be present within the specific area being investigated. Fauna considered unlikely to be present even if appearing in these database searches are not shown in the potential species list.

3.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past. The most significant of the publicly available surveys have been used as the primary reference material for compiling the potential fauna assemblage for the general area.

Those reports referred to included, but were not limited to:

- Bamford, M.J and A.R. (2000). Proposed Gwindinup Mineral Sands Mine. Fauna Surveys; August and December 1999. Unpublished report for Cable Sands WA. January 2000.

- Bamford, M.J and A.R (2001). Fauna Survey of the Ludlow Mining Lease. Final Report. Unpublished report for Cable Sands (WA) Pty Ltd. November 2001.

- Bancroft, W. and Bamford, M. (2008). Fauna values of Bemax's Happy Valley mineral sands deposit. Unpublished report for Bemax Resources Limited. January 2008.

- Biologic (2014). Wonnerup North Vertebrate Fauna Assessment. Unpublished report for Cristal Mining Australia Ltd.

- Biota (2007a). Yoganup 215 Strand Fauna and Faunal Assemblage Survey. Unpublished report for Iluka Resources. February 2007.

- Biota (2007b). Tutunup South Fauna Habitat and Fauna Assemblage Seasonal Survey. Unpublished report for Iluka Resources. December 2007.

- Biota (2009). Tutunup Fauna Assemblage and Fauna Habitat Seasonal Survey. Unpublished report for Iluka Resources. March 2009.

- Harewood, G (2008). Fauna Assessment Survey - Lot 187 Stratham. Unpublished report for MBS Environmental. January 2008.

- Harewood, G (2010). Terrestrial Fauna Survey (Level 1) of Capel Dry Plant Study Area, Capel. Unpublished report for Iluka Resources Ltd. September 2010.

- Harewood, G. (2012). Phase 1 and 2 Seasonal Fauna Surveys (Level 2). Yoongarillup Mineral Sands Project. Unpublished report for Doral Mineral Sands Pty Ltd.

- Harewood, G. (2013). Fauna Assessment of Yoganup Extended. Unpublished report for Iluka Resources Ltd.

- Harewood, G (2017). Fauna Assessment Lot 3833 (Part), Hyder Road. Unpublished report for Iluka Resources Limited. February 2017.

- Hart, Simpson and Assoc. (1997). Wonnerup -Tutunup Road - Vertebrate Fauna. Unpublished report for Westralian Sands Ltd.

- Ninox (2006). A Vertebrate Fauna Assessment of the Yoganup Mineral Sands Project Area. Unpublished report for Iluka Resources. March 2006.

As with the database searches some reports refer to species that would not occur in the subject site due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

3.1.3 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Administered by the Australian Government DotEE;

- *Wildlife Conservation Act 1950* (WC Act). Administered by the Western Australia DBCA. It should be noted that the WC Act is soon to be repealed and replaced by the *Biodiversity Conservation Act 2016*;

- Wildlife Conservation (Specially Protected Fauna) Notice 2017 (Government of Western Australia 2018);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- DBCA Priority Fauna list. A non-statutory list maintained by the DBCA for management purposes (DBCA 2018a).

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[1];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (MNES) under the EPBC Act.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the subject site has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes is provided in Appendix A.

A number of other species not listed in official lists can also be considered of local or regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of birds have been listed as species of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998, 2000a and 2000b). The bird species are often referred to as “Bush Forever Decreaser Species”.

[1] Note – Some species listed under JAMBA are also protected under Schedule 5 of the WC Act.

The three categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced populations on the Swan Coastal Plain. (code Bp)
- Extinct in the Perth region (code Be).

The presence of Bush Forever species was taken into some consideration when determining the fauna values of an area. Bush Forever decreaser species are indicated as such within the species list held in Appendix B.

3.1.4 Invertebrate Fauna of Conservation Significance

For this assessment the review of potential conservation significant invertebrates has been limited to those listed by the DBCA and EPBC Act database searches (which rely on distribution records and known habitat preferences).

3.1.5 Likelihood of Occurrence – Fauna of Conservation Significance

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the subject site itself. The rankings and criteria used were:

- Would Not Occur: There is no suitable habitat for the species in the subject site and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20 km of the subject site. Populations do however persist outside of this area.
    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the southern forest regions. Populations do however persist outside of this area.
- Unlikely to Occur: The subject site is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the subject site itself would not support a population or part population of the species.

- Possibly Occurs: The subject site is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field assessment, supported in some cases by recent records being documented in literature from within or near the subject site. In some cases, while a species may be classified as possibly occurring, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question was positively identified as being present (for sedentary species) or as using the subject site as habitat for some other purpose (for non-sedentary/mobile species) during the field survey. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. foraging debris, tracks and scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

3.1.6 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report is generally taken from the DBCA's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles and Johnstone (2001) for birds. Jackson and Groves (2015) has been used for mammals.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Cogger (2014), Wilson and Swan (2017), Van Dyck *et al.* (2013), Christidis and Boles (2008), Bush *et al.* (2010), Bush *et al.* (2007), Tyler *et al*. (2009), and Glauret (1961). Not all common names are generally accepted.

3.2 SITE SURVEYS

The first phase of the assessment of the subject site involved a day time field survey on 1 December 2017 and a nocturnal survey on 4 December 2017. The second phase of day and night time survey work over some additional areas added subsequent to the first round of surveys was carried out on 8 and 9 March 2018, respectively. All survey work was done by Greg Harewood (Zoologist).

Weather conditions at the time of the surveys in December 2017 were mild with temperatures ranging from about 7°C to 24°C. Some light drizzle was experienced on the morning of 4 December 2017. Weather conditions in March 2018 were warmer with temperatures ranging from 16°C up to about 26°C.

3.2.1 Fauna Habitat Assessment

Vegetation units, landforms and soils observed during the field reconnaissance survey have been used to define broad fauna habitat types across the subject site. This information has been supplemented with observations made during a flora and vegetation survey carried out by EcoEdge (2015).

The main aim of this facet of the assessment was to determine if it was likely that any species of conservation significance would be utilising the subject site based on the presence of suitable habitat. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the subject site were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

3.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during all field survey work which primarily involved a series of transects across the subject site during the day surveys while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

Evidence of the presence or likely presence of fauna species of conservation significance (including suitable habitat) was searched for and recorded concurrent with this aspect of the survey work. The aim was to obtain sufficient information to make a definitive comment on the likely significance of the subject site to species of conservation significance which may be present which were not the subject to targeted assessments.

3.2.3 Black Cockatoo Habitat Assessment

The following methods were employed to comply with the defined scope of works and are based on guidelines published by the federal DotEE (Commonwealth of Australia 2012) which states that surveys for black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);

- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

Habitat used by black cockatoos have been placed into three categories by the DotEE (Commonwealth of Australia 2012) these being:

- breeding habitat;
- foraging habitat; and
- night roosting habitat.

So as to comply with the requested scope of works and in line with the published guidelines the following was carried out.

3.2.3.1 Black Cockatoo Breeding Habitat

The black cockatoo breeding habitat assessment has involved the identification of all suitable breeding trees species within the subject site that have a Diameter at Breast Height (DBH) of equal to or over 50 cm. The DBH of each tree was estimated using a pre-made 50 cm caliper.

Target tree species included marri and jarrah and any other *Corymbia/Eucalyptus* species of a suitable size that were present. Peppermints, *banksia*, sheoak and melaleuca tree species (for example) were not assessed as they typically do not develop hollows that are used by black cockatoos.

The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) were marked with “H” using spray paint.

Potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = ~<5 cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~5 cm-10 cm diameter (i.e. entrance too small for a black cockatoo);
- Large = ~>10 cm diameter (entrance large enough for a black cockatoo but possible hollow appears to be unsuitable for nesting i.e. wrong orientation, too small, too low or too shallow); or
- Large (cockatoo) = ~>10cm diameter (entrance appears big enough to provide access to a possible hollow that maybe suitable for a black cockatoo to use for nesting).

Based on this assessment, trees present within the subject site have then been placed into one of four categories:

- Tree < 50 cm DBH or an unsuitable species (not assessed/recorded);
- Tree >50 cm DBH, no hollows seen;
- Tree >50 cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree >50 cm DBH, one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this study a tree containing a potential cockatoo nest hollow was defined as generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by black cockatoos for the purpose of nesting/breeding. Hollows that had an entrance greater than about 10 cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, was recorded as a “potential nest hollow”.

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches).

3.2.3.2 Black Cockatoo Foraging Habitat

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around the base of trees) observed during the field survey was recorded. The nature and extent of potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

3.2.3.3 Black Cockatoo Roosting Habitat

Direct and indirect evidence of black cockatoos roosting within trees within the subject site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

3.2.4 Western Ringtail Possum Assessment

3.2.4.1 Daytime Survey

Two day time surveys to locate and record dreys, obvious tree hollows, scats and individual WRPs were carried out concurrent with the black cockatoo habitat assessments and involved a series of close spaced traverses on foot across the subject site.

3.2.4.2 Night Time Survey

Two night time surveys to locate and record individual WRPs were carried out and involved a series traverses across sections of the subject site, on foot using a LED head torch.

3.2.4.3 Habitat Assessment

Description and comments on the amount and quality of WRP habitat within the subject site are provided based on observations made during the site surveys.

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore indicative of the environmental condition of the subject site at the time of the field assessments. It should also be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring within the subject site based on there being suitable habitat (quality and extent) within the subject site or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the subject site.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitat or microhabitat within the subject site. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the subject site for some purpose. Some species may be present in the general area but may only use the subject site itself on rare occasions or as vagrants/transients.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the subject site (or immediately adjacent), as identified through ecological databases, publications,

discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the subject site.

During the black cockatoo habitat survey a search for trees containing hollows was completed. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally, the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

It should also be noted that even under ideal conditions not all WRPs present in an area being surveyed may be observed. As such the results of the survey presented here should be taken as representing the minimum number of WRPs present within the area surveyed at the time.

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 m, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

5. RESULTS

5.1 POTENTIAL FAUNA INVENTORY – LITERATURE REVIEW

A list of fauna species considered most likely to occur in the subject site has been compiled from information obtained during the literature review and is presented in Appendix B.

With respect to native vertebrate fauna, 11 mammals (includes eight bat species), 89 bird, 13 reptile and eight frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject area at times. Eight species of introduced animals could also frequent the area.

Of the 121 native animals that are listed as potentially occurring in the area, five are considered to be endangered/vulnerable or in need of special protection under State and/or Federal law. One DBCA priority species has also been listed as potentially present (Table 1).

Table 1: Potential Vertebrate Fauna of Conservation Significance using the Subject Site.

Species	Conservation Status	
	WC Act/ DBCA Priority	EPBC Act
Peregrine Falcon *Falco peregrinus*	S7	-
Carnaby`s Cockatoo *Calyptorhynchus latirostris*	S2	EN
Baudin's Cockatoo *Calyptorhynchus baudinii*	S2	EN
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*	S3	VU
Quenda *Isoodon fusciventer*	P4	-
Western Ringtail Possum *Pseudocheirus occidentalis*	S1	VU

See Appendix A for conservation status codes

5.2 SITE SURVEYS

5.2.1 Fauna Habitat Assessment

The subject site is located in the western section of the southern Swan Coastal Plain. The Swan Coastal Plain (SWA) was classified as part of the Interim Biogeographic Regionalisation for Australia (IUCN) and is in broad terms described as a:

"Low lying coastal plain mainly covered with Woodlands. It is dominated by Banksia or Tuart on sandy soils, Allocasuarina obesa on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah Woodland. Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by A. obesa – Marri Woodlands and Melaleuca shrublands, are extensive only in the south." (Thackway and Cresswell, 1995)

The subject site itself is within a further defined subregion of the SWA referred to as the Swan Coastal Plan subregion or the Perth subregion (SWA2). This is defined as:

"Colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia and Jarrah - Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials. Includes a complex series of seasonal wetlands and also includes Rottnest, Carnac and Garden Islands etc. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean". The subregion has an area of about 1,333,900 ha (Mitchell *et al.* 2002).

The subject site itself is highly degraded and with the exception of some scattered/groves of marri (*Corymbia calophylla*) and flooded gum (*Eucalyptus rudis*) contains only a small percentage of native vegetation.

The northern section of the subject site contains a decommissioned residue dam with some limited regrowth in a central high point. The residue dam is bordered by a grassland of introduced species with some areas of highly degraded open woodland of marri, flooded gum and/or planted non-endemic eucalyptus. The western most portion of the subject site contains a paddock area with widely scattered trees.

The southern half of the subject site contains an artificial lake into which process water was historically pumped. The lake has some open water though most areas are covered with a dense *Typha orientalis* reed bed. The lake is bordered mainly by planted endemic and non-endemic eucalyptus trees and shrubs with some marri, flooded gum, peppermint (*Agonis flexuosa*), tuart (*Eucalyptus gomphocephala*) and paperbark (*Melaleuca* sp.) also being present. A small grove of paperbark, marri and flooded gum covers a section of the subject site in its south west corner.

The subject site also contains two buildings in its southern section and these are also bordered in part by planted vegetation including endemic and non-endemic eucalyptus trees and various shrubs. The balance of the site contains carparks.

Overall fauna habitat quality is poor as a result of the sites high degree of historical disturbance. Connectivity to other areas of bushland is also very limited with the patchy, degraded bushland along Gavin's Road providing a tenuous linkage to vegetation within the railway reserve to the east. These factors coupled with relatively small size of the subject site suggest that the original biodiversity has been significantly reduced from its original levels with only a fraction of the original fauna assemblage likely to occur.

Descriptions and example images of the main fauna habitats/dominant vegetation present within the subject site are provided in Table 2. The location and extent of each of the identified habitat/vegetation units is shown in Figure 3.

Table 2: Main Fauna Habitats within the Subject Site

Fauna Habitat Description	Example Image
Decommissioned residue dam with some limited regrowth of trees and shrubs. Total Area = ~0.8 ha	
Open woodland of flooded gum and planted non-endemic eucalypts and shrubs over a grassland of introduced species. Total Area = ~0.3 ha	
Open woodland of marri over a grassland of introduced species with small number of planted trees/shrubs and regrowth peppermint. Total Area = ~1.2 ha	

Fauna Habitat Description	Example Image
Planted endemic (e.g. Tuart) and non-endemic eucalyptus trees, exotic trees and shrubs with some marri, flooded gum, peppermint and paperbark. over a grassland of introduced species. Includes planted gardens around administration buildings. Total Area = ~1.4 ha	
	
Low Woodland of paperbark with emergent marri and flooded gum over grassland of introduced species Total Area = ~0.2 ha	

Fauna Habitat Description	Example Image
Grassland with occasional scattered marri, flooded gum and planted non-endemic eucalypts or shrubs. Total Area = ~1.8 ha	
Artificial lake – mainly covered by a dense bed of *Typha orientalis* with some small areas of open water. Total Area = ~0.6 ha	

5.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix B. A total of 27 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the day and night time surveys. One introduced species was also confirmed as being present. Besides the two species of black cockatoo and the WRPs recorded, no conclusive evidence of any additional fauna species of conservation significance being present was observed.

- Clicking Frog - *Crinia glauerti*
- Slender Tree Frog - *Litoria adelaidensis*
- Common Bronzewing - *Phaps chalcoptera*
- Pacific Black Duck - *Anas superciliosa*
- Australian Wood Duck - *Chenonetta jubata*
- Brown Honeyeater - *Lichmera indistincta*

- Red Wattlebird - *Anthochaera carunculata*
- New Holland Honeyeater - *Phylidonyris novaehollandiae*
- Weebill - *Smicrornis brevirostris*
- Western Gerygone - *Gerygone fusca*
- Silvereye - *Chrysococcyx lucidus*
- Splendid Fairy-wren - *Malurus splendens*
- Striated Pardalote - *Pardalotus striatus*
- Straw-necked Ibis - *Threskiornis spinicollis*
- Grey Butcherbird - *Cracticus torquatus*
- Shining Bronze Cuckoo - *Chrysococcyx lucidus*
- Willie Wagtail - *Rhipidura leucophrys*
- Rufous Whistler - *Pachycephala rufiventris*
- Grey Fantail - *Rhipidura fuliginosa*
- Tree Martin - *Hirundo nigricans*
- Galah - *Cacatua roseicapilla*
- Australian Ringneck - *Platycercus zonarius*
- Red-capped Parrot - *Platycercus spurius*
- Baudin's Cockatoo - *Calyptorhynchus baudinii* (Endangered (WA/Federal))
- Forest Red-tailed Black Cockatoo - *Calyptorhynchus banksii naso* (Vulnerable (WA/Federal))
- Red Fox - *Vulpes vulpes* (Introduced)
- Common Brushtail Possum - *Trichosurus vulpecula*
- Western Ringtail Possum - *Pseudocheirus occidentalis* (Critically Endangered (WA), Vulnerable (Federal))

5.2.3 Black Cockatoo Habitat Assessment

5.2.3.1 Black Cockatoo Breeding Habitat

Trees considered potentially suitable for black cockatoos to use as nesting habitat (using DotEE criteria i.e. DBH ≥50 cm (Commonwealth of Australia 2012) but ultimately subject to a suitable hollow being present or developing and a range of other factors) which were found within the subject site comprised the following species:

- Marri – *Corymbia calophylla*;
- Tuart – *Eucalyptus gomphocephala* (planted);
- Flooded Gum – (*Eucalyptus rudis*);
- Dead unidentified eucalyptus; and
- Unidentified non-endemic eucalyptus (planted).

A summary of the potential black cockatoo habitat trees observed within the subject site is provided in Table 3 below and their location shown in Figure 4.

Table 3: Summary of Potential Black Cockatoo Habitat Trees (DBH ≥50 cm) within the Subject Site

Tree species	Total Number of Habitat Trees Recorded	Number of Trees with No Hollows Observed	Number of Trees with Hollows Considered Unsuitable for Nesting Black Cockatoos	Number of Trees with Hollows Considered Possibly Suitable for Nesting Black Cockatoos
Marri	26	23	2	1
Tuart	10	10	0	0
Flooded Gum	1	0	0	1
Dead unidentified Eucalyptus	2	0	2	0
Non-endemic Eucalyptus	16	16	0	0
Total	**55**	**49**	**4**	**2**

The assessment identified a total of 55 trees with a DBH of ≥50 cm within the subject site. The majority (49, ~89.1%) of the trees were not observed to contain hollows of any size. Four (4, ~7.3%) of the trees contained one or more possible hollows considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Two trees (2, ~3.6%) were identified as potentially containing hollows that appeared possibly big enough to allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk though conclusive evidence of actual use by black cockatoos was not seen. It should be noted that these trees are unlikely to fall within the proposed works footprint and therefore will not be directly impacted on.

Additional details on each habitat tree observed can be found in Appendix D.

The subject site falls within the mapped breeding range of Carnaby's cockatoo as depicted in the most current recovery plan produced by DBCA (Figure 2 - DPaW 2013). Bamford (2004) reports a breeding attempt by Carnaby's cockatoo in the Ludlow Tuart Forest in 2003 at a point about 8 km south west of the subject site (Figure 5). A review of other available data revealed several breeding records in Dalyellup and at Hithergreen for Carnaby's cockatoo but none from the vicinity of the subject site (i.e. within 12 km).

The DBCA recovery plan for Baudin's cockatoo and the forest red-tailed black cockatoo (DEC 2008) does not specifically define any known breeding areas for either species. Johnstone and Kirkby (2011) also do not specifically mention breeding areas of either species within the area though both are noted as utilising marri trees (and other tree species) for breeding in the south west.

While there appears to be a paucity of breeding data for the general area this could simply be a consequence of a lack of survey work or a lack of publicly available data. Based on available vegetation mapping it is however estimated that there is approximately 8,195 ha of native vegetation within 12 km the subject site (Figure 5). A significant portion of this vegetation is located within the Tuart Forest National Park (total area 3,030 ha), most of which falls within 12 km of the subject site. Given these facts, there is significant potential for breeding to take place in the wider area (assuming the presence of suitable trees).

The results therefore suggest that the removal of some or all of the identified "habitat trees" from within the subject site is unlikely to have significant direct or indirect impact on breeding black cockatoos and is also unlikely to significantly impact on the total "breeding habitat" resource available in the wider area.

5.2.3.2 Black Cockatoo Foraging Habitat

Following is a list of the main plant species observed within the subject site that are known to be used as a direct food source (i.e. fruits or flowers) by one or more species of black cockatoo:

- Marri - *Corymbia calophylla;*
- Flooded Gum – *Eucalyptus rudis;*
- Tuart – *Eucalyptus gomphocephala* (planted); and
- Bottlebrush - *Callistemon sp. (planted).*

It should be noted that flooded gum, tuart and bottlebrush, while species documented as being fed upon by black cockatoos of at least one species, would not represent a significant proportion of any one birds' diet as these plant species are a high effort, low yield food source. Marri woodland makes up about 1.2 ha of the subject site..

Foraging evidence of two species of black cockatoos within the subject site was observed. This foraging evidence was in the form of chewed marri fruits and was attributed to the forest red-tailed black cockatoo or Baudin's cockatoo depending on the nature of the marks left on discarded fruits.

Based on available vegetation mapping it is estimated that there is approximately 8,195 ha of native vegetation within 12 km the subject site (~17.7% of total area, though it should be noted that a high proportion of the total area within 12 km of the subject site is ocean), much of which is very likely to represent potential black cockatoo foraging habitat of some type. There is also up to 445 ha of pine plantations within 12 km of the subject site (Figure 5). Pines are likely to be a significant foraging resource for Carnaby's cockatoos (and possibly Baudin's cockatoo) in this area.

It is difficult to calculate the actual extent of natural, quality foraging habitat within the subject site given it is largely comprised of patchy fragmented vegetation, but it is unlikely to total more than about 1.2 ha (i.e. area of marri). This area represents less than 0.0014% of the potential foraging habitat (including pines) within 12 km of the subject site.

The results therefore suggest that the potential removal of some or all of the vegetation from the subject site is unlikely to have a significant impact on the availability of foraging resources for black cockatoos in the general area.

5.2.3.3 Black Cockatoo Roosting Habitat

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey, which included a single dusk survey (prior to the WRP nocturnal survey).

A review of available data revealed a single documented roost site about 10 km south west of the subject site in or near the Ludlow Tuart Forest (Johnstone and Kirkby 2011). They also show other roost sites further south near Busselton and Tutunup (Figure 5).

While there appears to be a paucity of documented roosting sites for the general area this could simply be a consequence of a lack of survey work or a lack of publicly available data. Based on available vegetation mapping it is however estimated that there is approximately 8,195 ha of native vegetation within 12 km the subject site (Figure 5). A significant portion of this vegetation is located within the Tuart Forest National Park (total area 3,030 ha), most of which falls within 12 km of the subject site. Given this fact, there is significant potential for roosting to take place in the wider area (assuming the presence of suitable trees).

The results suggest that the removal of the relatively small number of trees from the subject site will not have any direct impact on roosting black cockatoos and also will not significantly impact on roosting opportunities available in the area.

5.2.4 Western Ringtail Possum Assessment

5.2.4.1 Daytime Survey

Thirteen WRP dreys were observed during the day surveys (Figure 6). It should be noted that forks in trees, subtle cavities in tree trunks, fallen hollow logs, rabbit burrows and dense ground cover (e.g. sword grass/sedges) are also use by WRPs for daytime refuge and therefore observations of dreys only provide a guide to WRP habitat use/quality as other opportunities for daytime refuge may exist. WRP also build and use a number of dreys within their home range. Dreys also maybe abandoned but remain insitu for long periods of time even when not used or maintained. Because of these facts the number of dreys observed should not be used to determine current areas of occupancy/species abundance.

WRP scats were also observed at several locations. In most areas dense groundcover made searching for scats difficult and time consuming and therefore this method for determining WRP presence was not employed extensively.

5.2.4.2 Night Time Survey

The nocturnal survey observations are shown in Figure 6. Eight WRPs and three common brushtail possums were recorded within a section of the subject site during the first nocturnal survey. Six WRPs and one common brushtail possum were recorded within a section of the subject site during the second nocturnal survey. It should be noted that while different areas were examined during each nocturnal count there was some overlap in the area surveyed (i.e. vegetation around the Administration building) and it is likely that the animals recorded in this specific area on the second night survey are some of the same individuals seen during the first survey. Combining results but excluding likely

recounts would suggest that the subject site is currently being utilised by at least 10 WRPs.

5.2.4.3 Habitat Assessment

Based on the observations made, the majority of the vegetation (natural and planted) within the subject site represents WRP habitat of some type (i.e. refuge, foraging or dispersal). The area of planted vegetation with a dense midstorey component surrounding the artificial lake and gardens surrounding the buildings in the southern half of the subject site would appear to be the best quality area given it is characterised by a coherent canopy structure, provides good drey building opportunities and contains the widest variety of potential food sources.

Based on available vegetation mapping it is estimated that there is approximately 8,195 ha of native vegetation within 12 km the subject site (Figure 5). A significant portion of this vegetation is located within the Tuart Forest National Park (total area 3,030 ha), most of which falls within 12 km of the subject site. While this vegetation has not been specifically assessed for its suitability as WRP habitat a high percentage is very likely to be suitable for WRPs. The Author's own database of WRP records made within the last 15 years from within 12 km of the subject site contains 301 individual observations which supports this conclusion (Note: NatureMap (2018) also shows a small number of additional observations made by others in this area).

These details suggest that the removal of some habitat from the subject site which appears to be currently in use by a relatively small number of WRPs is not likely to substantially impact on the species overall status in the wider area.

5.3 FAUNA INVENTORY – SUMMARY

5.3.1 Vertebrate Fauna

Table 4 summarises the number of vertebrate fauna species potentially occurring within or utilising at times the subject site, based on results from the literature review and observations made during the field assessment. A complete list of vertebrate fauna possibly inhabiting or frequenting the subject site is located in Appendix B.

As previously discussed, despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the subject site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the subject site.

Table 4: Summary of Potential Vertebrate Fauna Species (as listed in Appendix B)

Group	Total number of Potential species	Potential number of Specially Protected species	Potential number of Migratory species	Potential number of Priority species	Number of species recorded during field survey
Amphibians	8	0	0	0	2
Reptiles	13	0	0	0	0
Birds	92 (3)	4	0	0	20
Non-Volant Mammals	8 (5)	1	0	1	3 (1)
Volant Mammals (Bats)	8	0	0	0	0
Total	**129 (8)**	**5**	**0**	**1**	**25 (1)**

Brackets = number of introduced species included in total.

5.3.2 Vertebrate Fauna of Conservation Significance

The following vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period:

- Forest red-tailed black cockatoo *Calyptorhynchus banksii naso* – Vulnerable (WC Act/EPBC Act)
  Several individuals and foraging evidence attributed to this species were observed during the survey period (i.e. a few chewed marri fruits). A small amount of the native vegetation within the subject site represents quality foraging habitat (i.e. 1.2 ha of marri woodland and a small number of other marri trees). Fifty five larger trees (≥50 cm DBH) can be considered potential breeding habitat, with two trees possibly containing large hollows suitable for use for nesting by this species. Sixteen of the "habitat trees" appeared to be non-endemic eucalypt trees represented by at least two, presumed eastern states, species. It is not known if these tree species have the propensity to develop hollows suitable for black cockatoos. Trees within the subject site do not appear to be used for roosting.

- Baudin's Cockatoo *Calyptorhynchus baudinii* – Endangered (WC Act/EPBC Act)
  Foraging evidence attributed to this species was observed during the survey period (i.e. a few chewed marri fruits). A small amount of the native vegetation within the subject site represents quality foraging habitat (i.e. 1.2 ha of marri woodland and a small number of other marri trees). Fifty five larger trees (>50 cm DBH) can be considered potential breeding habitat, with two trees possibly containing large hollows suitable for use for nesting by this species. Sixteen of the "habitat trees" appeared to be non-endemic eucalypt trees represented by at least

two, presumed eastern states, species. It is not known if these tree species have the propensity to develop hollows suitable for black cockatoos. Trees within the subject site do not appear to be used for roosting.

- WRP *Pseudocheirus occidentalis* – Critically Endangered (WC Act), Vulnerable (EPBC Act)
  The results of the WRP assessment indicate that this species is utilising vegetation within the subject site as habitat. Individuals appear to be favouring areas containing reasonably dense midstorey vegetation largely represented by planted non-endemic plant species.

Based on the habitats present and current documented distributions it is considered possible that several additional species of conservation significance may use the subject site for some purpose at times, though, as no evidence of any was found at the time of the field survey, the status of some in the area remains uncertain.

These species are:

- Carnaby's cockatoo *Calyptorhynchus latirostris* – Endangered (WC Act/EPBC Act)
  No evidence of this species using the subject site was observed but it is known to frequent the general area and so may occur at least occasionally. A small amount of the native vegetation within the subject site represents quality foraging habitat (i.e. ~1.2 ha of marri woodland and a small number of other marri trees). Fifty five larger trees (≥50 cm DBH) can be considered potential breeding habitat, with two trees possibly containing large hollows suitable for use for nesting by this species. Sixteen of the "habitat trees" appeared to be non-endemic eucalypt trees represented by at least two, presumed eastern states, species. It is not known if these tree species have the propensity to develop hollows suitable for black cockatoos. Listed as a potential species based on available information.

- Peregrine falcon *Falco peregrinus* – Schedule 7 (WC Act)
  This species potentially utilises some sections of the subject site as part of a much larger home range though it is only likely to occur very infrequently. There are no suitable nest sites present. Listed as a potential species based on available information.

- Quenda *Isoodon fusciventer* – Priority 4 (DBCA Priority Species)
  No conclusive evidence of this species being present was found during the site survey, but it may occur where ever dense ground cover exists particularly in areas surrounding the artificial lake. Listed as a potential species based on available information.

As listed in Table 5 below, a number of other species of conservation significance, while possibly present in the wider area are not considered as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas), lack of suitable habitat and/or the presence of feral predators.

Twenty six species that potentially frequent or occur in the subject site are noted as Bush Forever Decreaser Species in the Perth Metropolitan Region (six were sighted/identified as having used the within the subject site during the survey). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the coastal plain as there have been marked reductions in range and population levels of many sedentary bird species because of disturbance and land clearing (Dell and Hyder-Griffiths 2002). The continued persistence of these species in other areas outside of the Perth area is therefore of significance.

5.3.3 Invertebrate Fauna of Conservation Significance

Two conservation significant invertebrate species appeared in the DBCA database search (DBCA 2018b), these being Carter's freshwater mussel (*Westralunio carteri*) and the western pygmy trapdoor spider (*Bertmainius opimus)*. None of these species are considered likely to occur primarily due to an obvious or apparent lack of suitable habitat.

6. LIKELIHOOD OF OCCURRENCE AND POTENTIAL IMPACTS

Fauna of conservation significance identified during the literature review as previously being recorded in the general area are listed in Table 5. Each has been assessed and ranked for their likelihood of occurrence within the subject site itself based on information obtained during the fauna assessment.

The exact location and extent of native vegetation clearing within the subject site that may be undertaken has yet to be finalised and therefore it is difficult to quantify impacts. The potential direct and indirect impact on fauna that may occur as a consequence clearing will be dependent on each fauna species habits, population density and the quantity and quality of potential habitat that will be affected.

In general, the most significant potential impacts to fauna of any development include:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees);
- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species;
- Modifications to surface hydrology, siltation of creek lines;
- Changes to fire regimes;
- Pollution (e.g. oil spills);

- Noise/Light/Dust;
- Spread of plant pathogens (e.g. dieback) and weeds;
- Potential increase in the number of predatory introduced species (e.g. cats, foxes);
- Death or injury of fauna during clearing and construction; and
- An increase in fauna road kills subsequent to development.

In this instance impacts are most likely to be related to the loss of small areas of habitat and the potential for some species to be killed or injured during clearing. Based on the maximum extent of clearing likely and the quality of habitats present, likely impacts on species of conservation significance previously recorded in the general area has been assessed, a summary of which is provided in Table 5 below.

Table 5: Likelihood of Occurrence and Potential Impacts – Fauna Species of Conservation Significance

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Potential Impacts
	WC Act/ DBCA Priority	*EPBC Act*				
Western Pygmy Trapdoor Spider *Bertmainius opimus*	P3	-	Not documented.	Could not be determined.	Unlikely to Occur. Natural habitats highly degraded.	No impact anticipated.
Carter's Freshwater Mussel Westralunio carteri	P1	-	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots.	No	Would Not Occur.	No impact.
Pouched Lamprey *Geotria australis*	P1	-	This species lives in mud burrows in the upper reaches of coastal streams for the first four years of life until migrating to the sea. Adults migrate up to 60km upstream during spawning.	No	Would Not Occur.	No impact.
Balston's Pygmy Perch *Nannatherina balstoni*	S3	VU	Acidic, tannin stained freshwater pools, streams and lakes within 30km of the coast, typically situated amongst peat flats. Prefers shallow water and is commonly found in association with tall sedge thickets.	No	Would Not Occur. Outside of documented distribution	No impact.
Perth Lined Lerista *Lerista lineata*	P3	-	This small species of skink inhabits white sands under areas of shrubs and heath where it inhabits loose soil and leaf litter particularly in association with banksias.	No	Would Not Occur. Outside of documented distribution	No impact.
Coastal Plains Skink *Ctenotus ora*	P3	-	Sandy substrates with low vegetation (including heath) in open *Eucalyptus/Corymbia* woodland over *Banksia*.	No/Marginal	Unlikely to Occur. Natural habitats highly degraded	No impact anticipated.
Blue-billed Duck *Oxyura australis*	P4	-	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	No/Marginal	Unlikely to Occur. Wetland area too small.	No impact anticipated.
Glossy Ibis *Plegadis falcinellus*	S5	Mig	Well vegetated wetlands, wet pastures, rice fields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats, occasionally dry grasslands.	No/Marginal	Unlikely to Occur. Very uncommon in SW, may occur very occasionally.	No impact anticipated.
Hooded Plover *Charadrius rubricollis*	P4	Ma	Broad sandy ocean beaches and bays, coastal and inland salt lakes.	No	Would Not Occur.	No impact.
Migratory Shorebirds/Wetland Species/Marine Species (various reptiles, birds and mammals)	S5, Various	Ma, Mig, Various	Varies between species but includes open ocean, beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.	No/Marginal for some species	Would Not Occur/Unlikely to Occur.	No impact anticipated.

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Potential Impacts
	WC Act/ DBCA Priority	*EPBC Act*				
Eastern Osprey *Pandion haliaetus*	S5	Ma, Mig	Coasts, estuaries, bays, inlets, islands, and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Ascends larger rivers.	No	Would Not Occur.	No impact.
Peregrine Falcon *Falco peregrinus*	S7	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes.	Yes	Possibly Occurs.	Loss/modification of a small area of foraging habitat and therefore likely low level of impact to population
Masked Owl (SW population) *Tyto n. novaehollandiae*	P3	-	Roosts and nests in heavy forest, hunts over open woodlands and farmlands.	No/Marginal	Unlikely to Occur but may occur very occasionally.	No impact anticipated.
Australasian Bittern *Botaurus poiciloptilus*	S1	EN	Freshwater wetlands, occasionally estuarine; prefers heavy vegetation such as beds of tall dense *Typha, Baumea* and sedges in freshwater swamps.	No/Marginal	Unlikely to Occur.	No impact anticipated.
Black Bittern *Ixobrychus flavicollis*	P1	-	Freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense waterside vegetation.	No/Marginal	Unlikely to Occur but may occur very occasionally.	No impact anticipated.
Little Bittern *Ixobrychus minutus*	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of *Typha, Baumea* and tall rushes in freshwater swamps around lakes and along rivers.	No/Marginal	Unlikely to Occur but may occur very occasionally.	No impact anticipated.
Carnaby's Cockatoo *Calyptorhynchus latirostris*	S2	EN	Forests, woodlands, heathlands, farms; feeds on *Banksia*, *Hakea* and Marri.	Yes	Possibly Occurs.	Loss/modification of a small area of habitat. and therefore, likely low level of impact to population
Baudin's Cockatoo *Calyptorhynchus baudinii*	S2	EN	Mainly eucalypt forests where it feeds primarily on the marri seeds.	Yes	Known to Occur.	Loss/modification of a small area of habitat and therefore likely low level of impact to population.
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*	S3	VU	Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble.	Yes	Known to Occur.	Loss/modification of a small area of habitat and therefore likely low level of impact to population.
Fork-tailed Swift *Apus pacificus*	S5	Ma, Mig	Low to very high airspace over varied habitat from rainforest to semi desert.	Yes	Unlikely to Occur, Flyover only on very rare occasions.	No impact.
Grey Wagtail *Motacilla cinerea*	S5	Mig, Ma	In Australia, near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields.	No	Would Not Occur.	No impact.

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Potential Impacts
	WC Act/ DBCA Priority	*EPBC Act*				
Chuditch *Dasyurus geoffroii*	S3	VU	Forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest.	No/Marginal	Unlikely to Occur, Locally extinct.	No impact anticipated.
South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger*	S6	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover.	No/Marginal	Unlikely to Occur, Habitat appears unsuitable.	No impact anticipated.
Quenda *Isoodon fusciventer*	P4	-	Dense scrubby, often swampy, vegetation with dense cover.	Yes/Marginal	Possibly Occurs.	Loss/modification of a small area of habitat and therefore likely low level of impact to population. Potential for death/injury of individuals during clearing.
Greater Bilby *Macrotis lagotis*	S3	VU	*Acacia* shrublands, spinifex and hummock grassland. Mitchell grass and stony downs country if cracking clay, also desert sand plains and dune fields sometimes with spinifex hummock grassland and *acacia* shrubland.	No	Would Not Occur. Regionally extinct.	No impact.
Western Ringtail Possum *Pseudocheirus occidentalis*	S1	VU	Coastal peppermint, coastal peppermint-tuart, jarrah-marri associations, sheoak woodland, and eucalypt woodland and mallee.	Yes	Known to Occur.	Loss/modification of a small area of habitat and therefore likely low level of impact to population. Potential for death/injury of individuals during clearing.
Quokka *Setonix brachyurus*	S3	VU	Currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems.	No	Would Not Occur.	No impact.
Woylie *Bettongia penicillata ogibyi*	S1	EN	Open sclerophyll forest and woodland with a low, dense, understorey of tussock grasses or woody scrub.	No	Would Not Occur, Locally extinct	No impact.
Western Brush Wallaby *Macropus irma*	P4	-	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets.	No/Marginal	Would Not Occur.	No impact.
Western False Pipistrelle *Falsistrellus mackenziei*	P4	-	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and marri forest.	Yes/Marginal	Unlikely to Occur except on rare occasions.	No impact anticipated.
Water Rat *Hydromys chrysogaster*	P4	-	Permanent water, fresh, brackish or marine.	No/Marginal	Unlikely to Occur	No impact anticipated.

See Appendix A for conservation status codes

7. CONCLUSION

The fauna assessment within the subject site was undertaken for the purposes of delineating and characterising the fauna habitats and faunal assemblages present. Targeted searches for black cockatoo and western ringtail possum individuals and their habitat were also carried out.

The assessment has identified relatively small areas of "potential" black cockatoo breeding and foraging habitat within the subject site and the presence of the WRP. A number of additional federal and/or state listed threatened and DBCA priority fauna species may also occur though in most cases their use of the subject site wasn't detected during the survey period.

With respect to native vertebrate fauna, 11 mammal (including eight bat species), 89 bird, 13 reptile and eight frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat. Overall fauna habitat quality appears to be relatively low given the areas high level of historical disturbance, its small size and limited connectivity to other bush remnants and as a consequence the fauna assemblage is likely to be depleted, relative to the areas original biodiversity.

Three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period:

- Baudin's cockatoo – Endangered (WA/Federal)
- forest red-tailed black cockatoo – Vulnerable (WA/Federal)
- WRP – Critically Endangered (WA), Vulnerable (Federal).

An additional three species of conservation significance may also utilise the subject site, though, as no evidence of these species presence was identified during the field survey, the status of some in the area remains uncertain:

- Carnaby's cockatoo – Endangered (WA/Federal)
- peregrine falcon – Schedule 7 (WA)
- quenda – Priority 4 (WA).

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8. REFERENCES

Aplin, K.P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

Bamford, M.J and A.R. (2000). Proposed Gwindinup Mineral Sands Mine. Fauna Surveys; August and December 1999. Unpublished report for Cable Sands WA. January 2000.

Bamford, M. and A. (2001). Fauna Survey of the Ludlow Mining Lease. Final Report. Unpublished report for Cable Sands (WA) Pty Ltd. November 2001.

Bamford, M.J and A.R. (2004). Survey of Short-billed Black Cockatoos (*Calyptorhynchus latirostris*) and Masked Owls (*Tyto novaehollandiae*) in the Ludlow Mining Lease 2003. Final Report. Unpublished report for Cable Sands (WA) Pty Ltd. January 2004.

Bancroft, W. and Bamford, M. (2008). Fauna values of Bemax's Happy Valley mineral sands deposit. Unpublished report for Bemax Resources Limited. January 2008.

Biologic (2014). Wonnerup North Vertebrate Fauna Assessment. Unpublished report for Cristal Mining Australia Ltd.

Biota (2007a). Yoganup 215 Strand Fauna and Faunal Assemblage Survey. Unpublished report for Iluka Resources. February 2007.

Biota (2007b). Tutunup South Fauna Habitat and Fauna Assemblage Seasonal Survey. Unpublished report for Iluka Resources. December 2007.

Biota (2009). Tutunup Fauna Assemblage and Fauna Habitat Seasonal Survey. Unpublished report for Iluka Resources. March 2009.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Field Guide to Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.

Christidis, L. and Boles, W.E. (2008). Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Melbourne.

Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.

Commonwealth of Australia (2012). *EPBC Act* 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*.

Dell, J., & Hyder-Griffiths, B. (2002). A Description of the Fauna Values of the Muddy Lakes Area of the South Bunbury to Capel Coastal Corridor. Department of Environmental Protection, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) (2018a). Threatened and Priority Fauna Rankings. 16 January 2018.

Department of Biodiversity, Conservation and Attractions (DBCA) (2018b). NatureMap Database search. "By Circle" - 115° 34' 06" E, 33° 32' 42" S (plus 20km buffer), Available from: https://naturemap.dpaw.wa.gov.au/default.aspx. Accessed 12/03/2018.

Department of Environment and Conservation (DEC) (2008). Forest Black Cockatoo (Baudin's Cockatoo - *Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. Department of Environment and Conservation, Perth, Western Australia.

Department of Parks and Wildlife (DPaW) (2013). Carnaby's cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Western Australian Wildlife Management Program No. 52. Department of Parks and Wildlife, Perth, Western Australia.

Department of the Environment and Energy (DotEE) (2018). *EPBC Act* Protected Matters Report: Point Search 33.57899 115.52887 (1km Buffer) Available from: http://www.environment.gov.au. Accessed 12/03/2018.

EcoEdge (2015). Report of a Level 1 Flora and Vegetation survey at the Capel Dry Plant, Capel. Unpublished report for Iluka Resources Limited. November 2015.

EPA (2016). Technical Guidance – Terrestrial Vertebrate Fauna Surveys (replaces EPA (2004). Guidance for the Assessment of Environmental Factors No 56: Terrestrial Surveys for Environmental Impact Assessment, but not yet updated).

Glauret, L. (1961). A Handbook of the Lizards of Western Australia. Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (1998). Perth Bushplan.

Government of Western Australia (2000a). Bush Forever Volume 1. Policies, Principles and Processes. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2000b). Bush Forever Volume 2. Directory of Bush Forever Sites. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2018). Wildlife Conservation Act 1950. Wildlife Conservation (Specially Protected Fauna) Notice 2017. Government Gazette, WA. 16 January 2018).

Harewood, G (2008). Fauna Assessment Survey - Lot 187 Stratham. Unpublished report for MBS Environmental. January 2008.

Harewood, G (2010). Terrestrial Fauna Survey (Level 1) of Capel Dry Plant Study Area, Capel. Unpublished report for Iluka Resources Ltd. September 2010.

Harewood, G. (2012). Phase 1 and 2 Seasonal Fauna Surveys (Level 2). Yoongarillup Mineral Sands Project. Unpublished report for Doral Mineral Sands Pty Ltd.

Harewood, G. (2013). Fauna Assessment of Yoganup Extended. Unpublished report for Iluka Resources Ltd.

Harewood, G (2017). Fauna Assessment Lot 3833 (Part), Hyder Road. Unpublished report for Iluka Resources Limited. February 2017.

Hart, Simpson and Assoc. (1997). Wonnerup -Tutunup Road - Vertebrate Fauna. Unpublished report for Westralian Sands Ltd.

Jackson, S. & Groves, C. (2015). Taxonomy of Australian Mammals. CSIRO Publishing.

Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

Mitchell, D., Williams, K., & Desmond, A. (2002). Swan Coastal Plan 2 (SWA2 – Perth subregion). In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions. Perth: Department of Conservation and Land Management.

Ninox (2006). A Vertebrate Fauna Assessment of the Yoganup Mineral Sands Project Area. Unpublished report for Iluka Resources. March 2006.

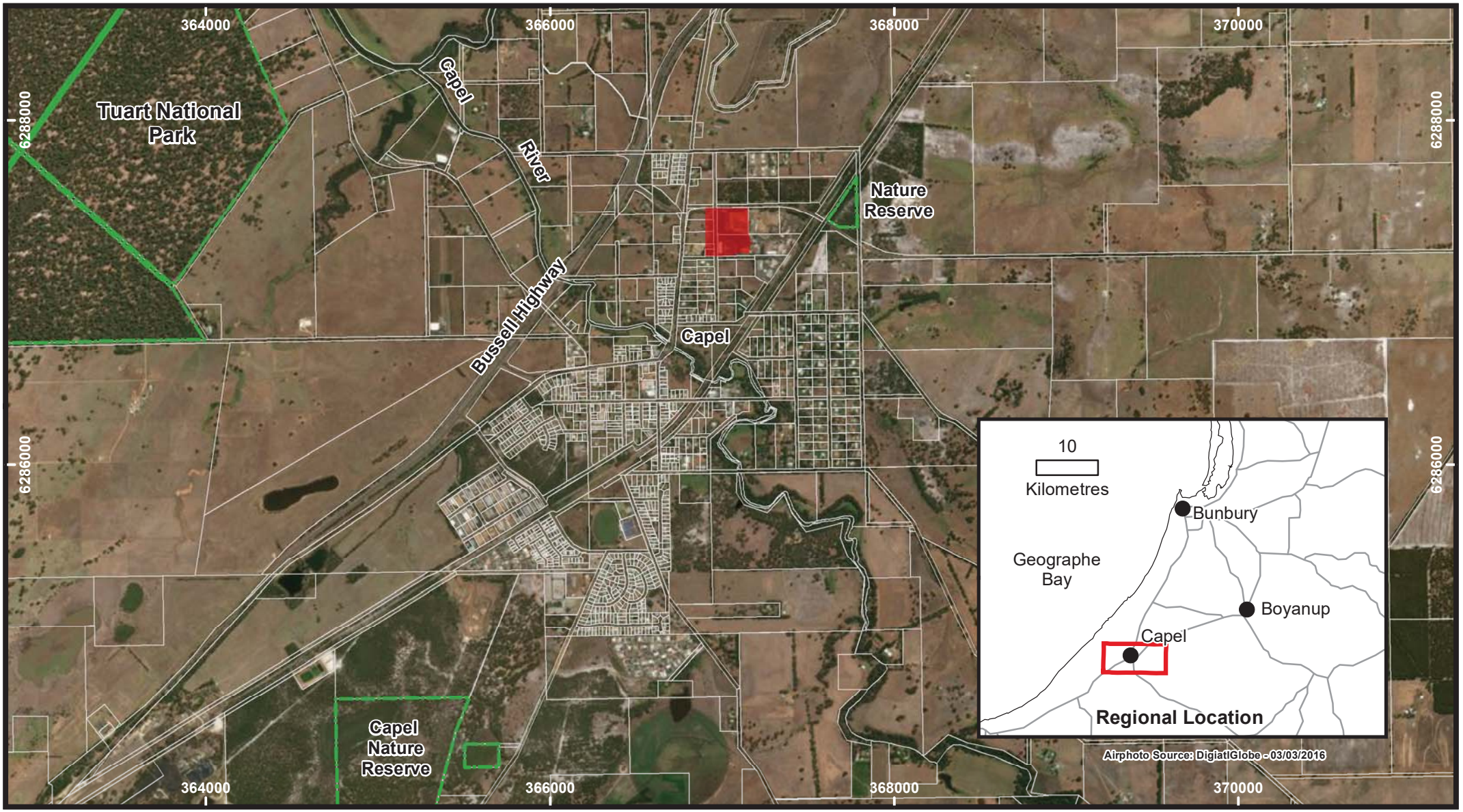
Thackway, R. and Cresswell, I.D. (1995). An Interim Biogeographic Regionalisation for Australia. Australian Nature Conservation Agency, Canberra.

Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.

Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.

Wilson, S. and Swan, G. (2017). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

FIGURES



Legend

- Subject Site
- Cadastral Boundaries
- National Park/Nature Reserve

N

0 0.5 1 1.5 2

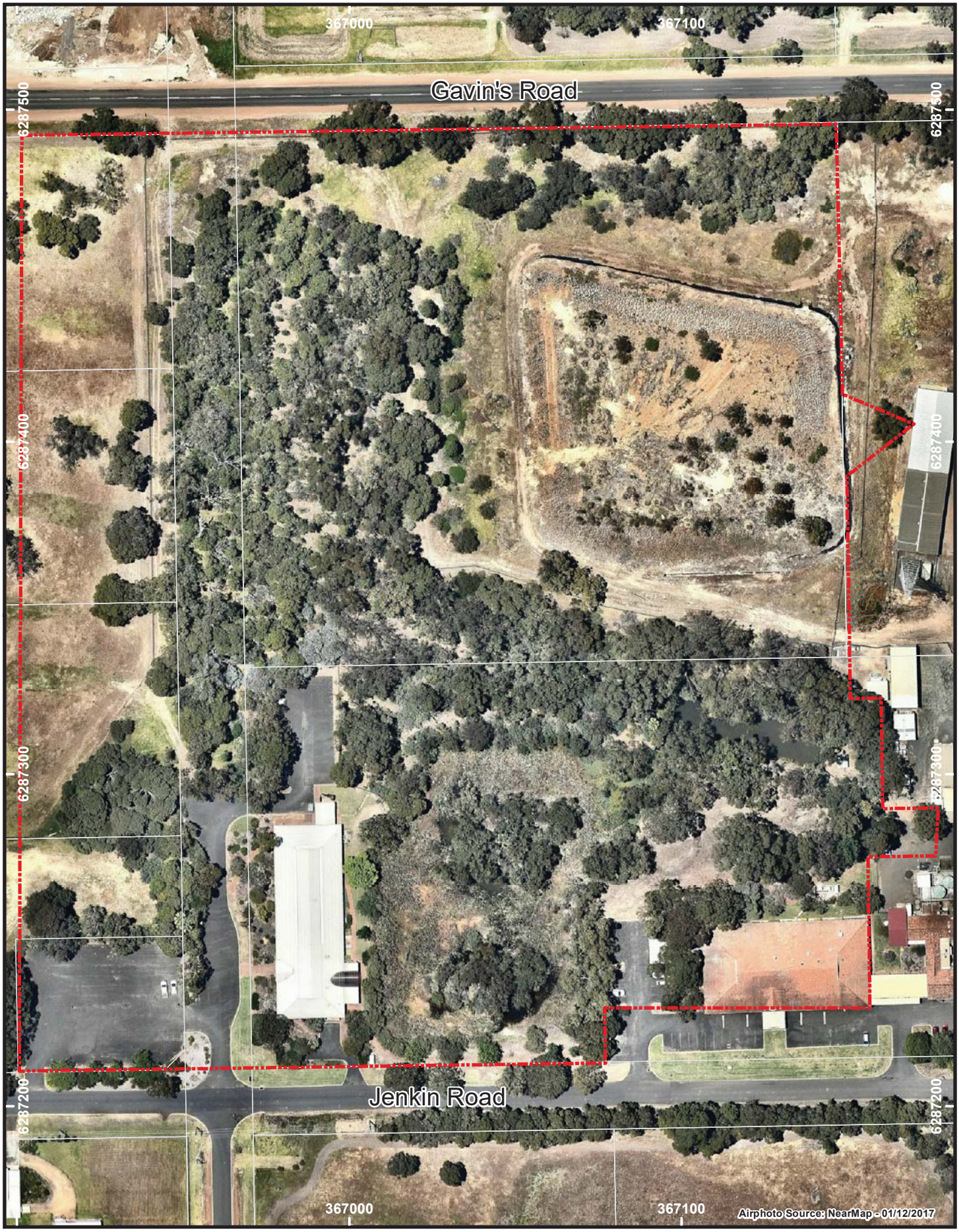
Kilometres

Capel Dry Plant
Iluka Resources Ltd

Subject Site and Surrounds

Drawn: G Harewood
Date: May 2018
Scale: 1:30,000
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 1



Legend

Subject Site

0 20 40 60 80 100

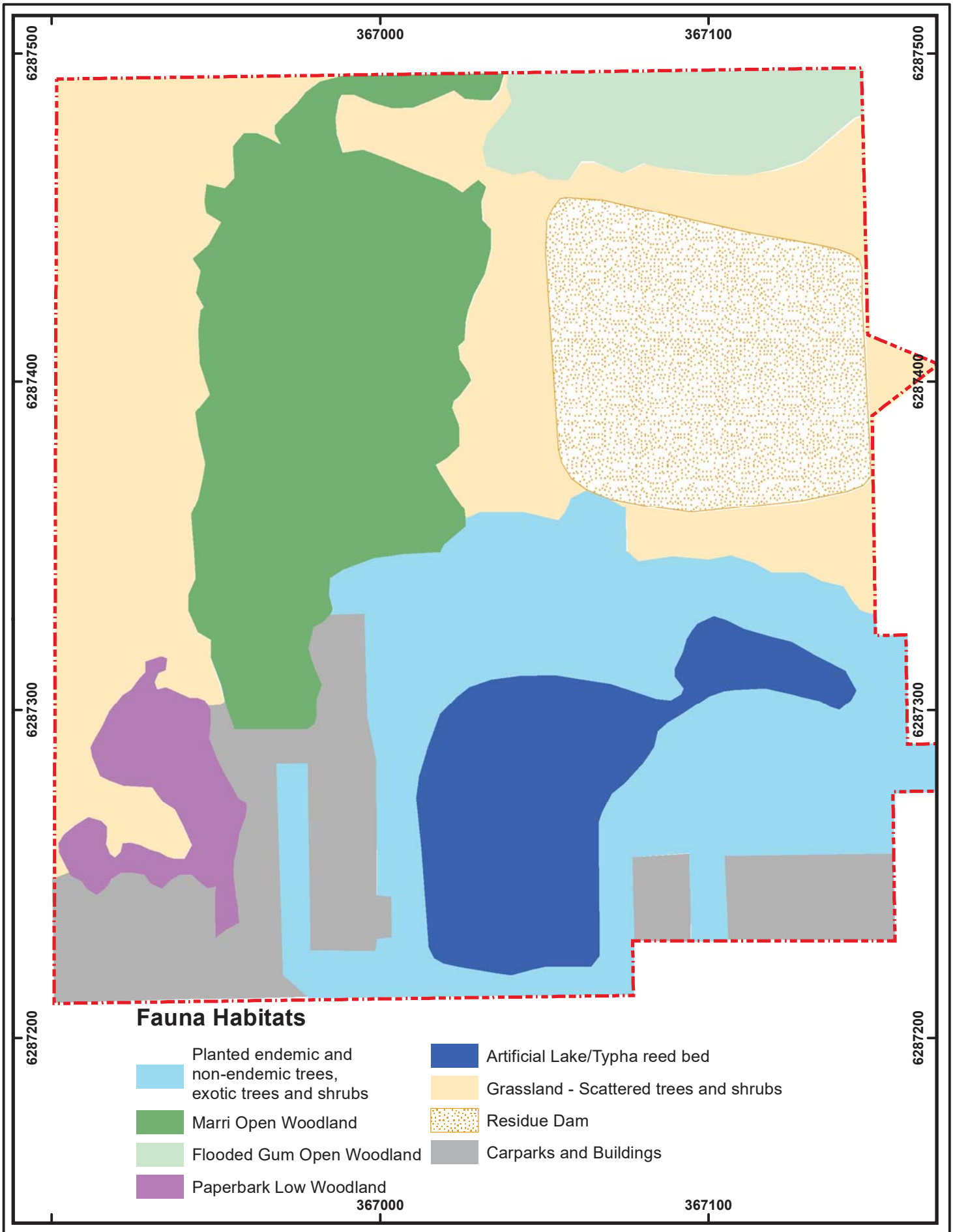
Metres

Fauna Survey

Capel Dry Plant
Iluka Resources Ltd

Subject Site Air Photo

Drawn: G Harewood	
Date: May 2018	
Scale: 1:1,500	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 2



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Subject Site

N

0 20 40 60 80 100

Metres

Fauna Survey

Drawn: G Harewood

Date: May 2018

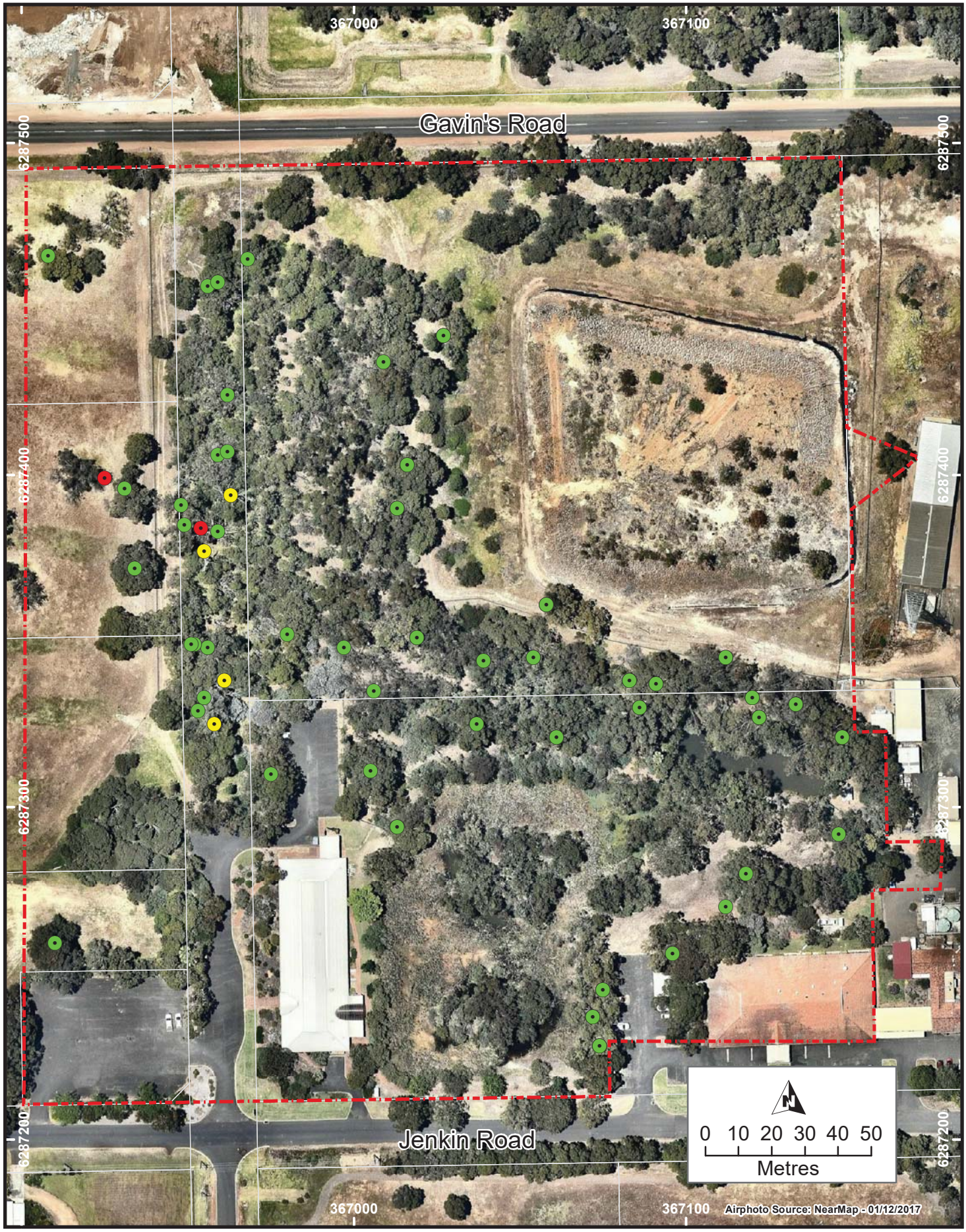
Scale: 1:1,500

Projection/Coordinate System: UTM/MGA Zone 50

Capel Dry Plant
Iluka Resources Ltd

Fauna Habitats

Figure: 3



Legend

- Subject Site
- Habitat Tree - One or more large hollows possibly suitable for black cockatoos
- Habitat Tree - One or more possible small/medium hollows
- Habitat Tree - No hollows seen

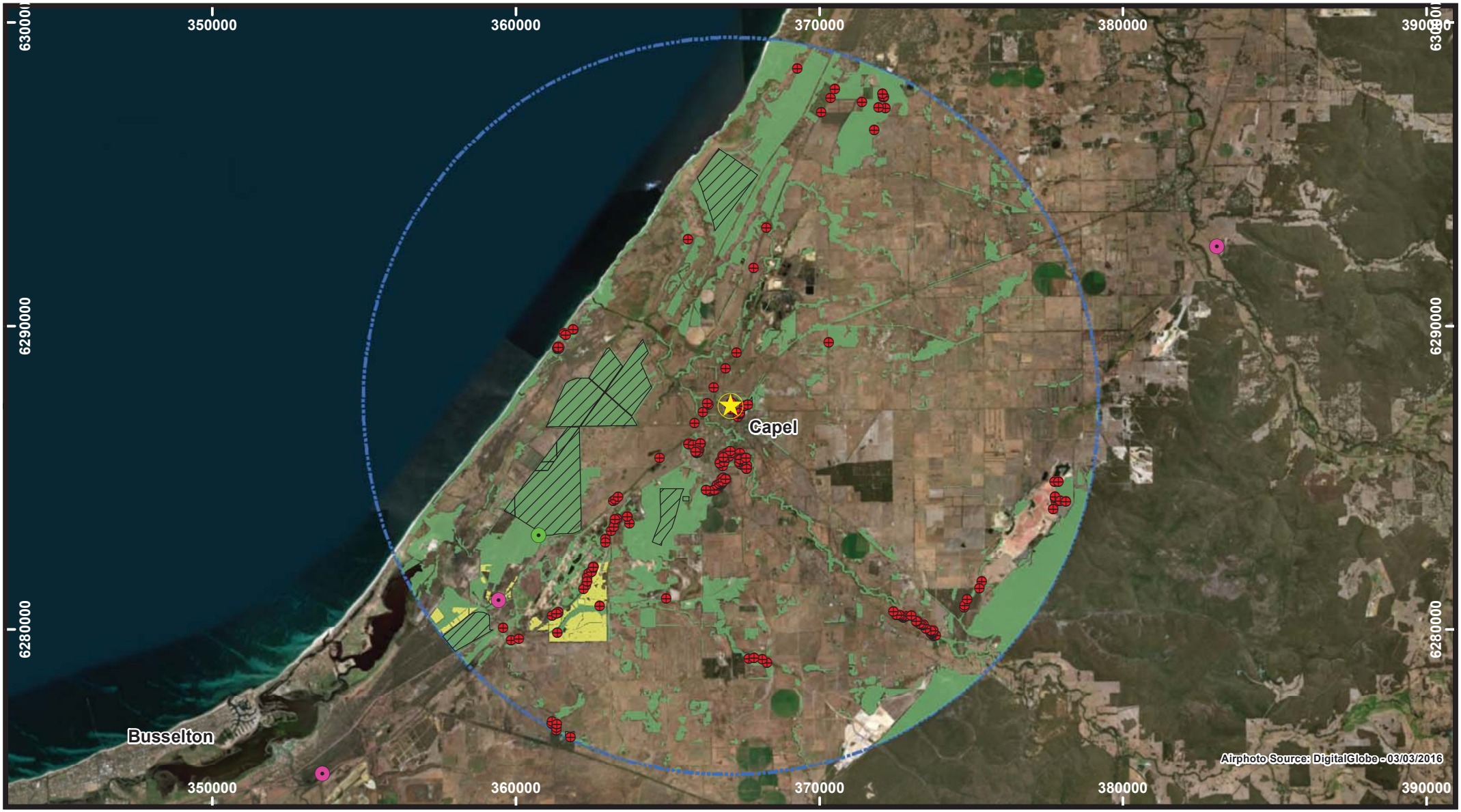
Fauna Survey

Capel Dry Plant
Iluka Resources Ltd

Habitat Trees (DBH≥50cm)

Drawn: G Harewood
Date: May 2018
Scale: 1:1,500
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 4



Legend

- Subject Site
- 12km Buffer
- National Park/Nature Reserve
- Remnant Native Vegetation
- Pine Plantations
- Documented Cockatoo Nest Site
- Documented Cockatoo Roost Site
- WRP Records (G. Harewood)

0 2 4 6 8 10
Kilometres

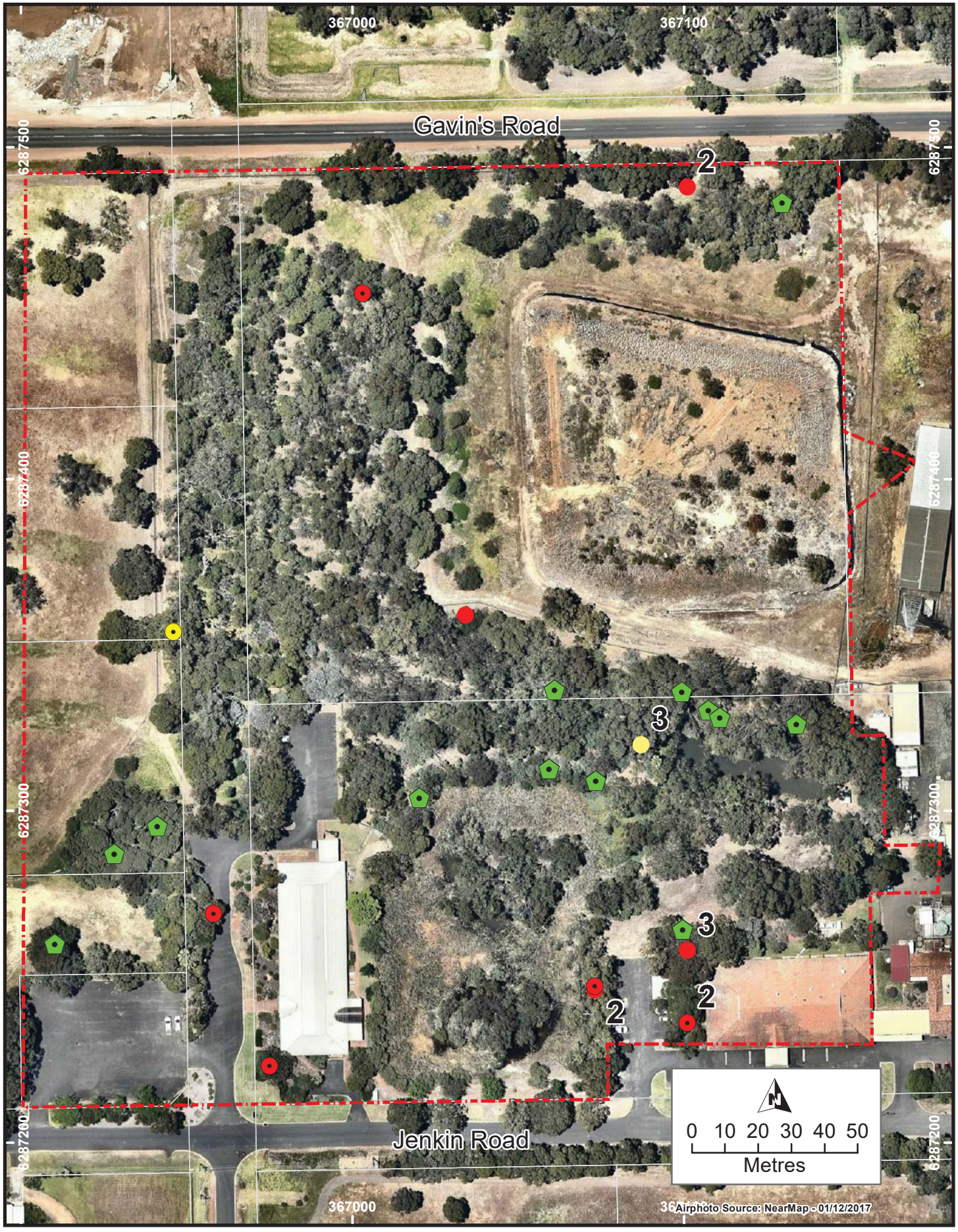
Fauna Survey

Capel Dry Plant
Iluka Resources Ltd

Regional Cockatoo and WRP Records

Drawn: G Harewood
Date: May 2018
Scale: 1:170,000
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 5



Legend

- CDP Combined Survey Area
- WRP Drey

Night 1

- Western Ringtail Possum
- Common Brushtail Possum

Night 2

- Western Ringtail Possum
- Common Brushtail Possum

Fauna Survey

Capel Dry Plant
Iluka Resources Ltd

Combined Possum Observations

Drawn: G Harewood	
Date: May 2018	
Scale: 1:1,500	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 6

APPENDIX A

CONSERVATION CATEGORIES

***EPBC Act (1999)* Threatened Fauna Categories**

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically Endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the *EPBC Act*

Note: Only species in those categories marked with an asterix are matters of national environmental significance (NES) under the *EPBC Act*.

Wildlife Conservation (Specially Protected Fauna) Notice 2015 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

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

Category	Code	Description
Schedule 1 Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2 Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3 Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4 Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5 Migratory birds protected under an international agreement	IA	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6 Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7 Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

Western Australian DBCA Priority Fauna Categories

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

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

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

Category	Code	Description
Priority 1 Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 Rare, Near Threatened and other species in need of monitoring.	P4	(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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

***IUCN Red List* Threatened Species Categories**

The *IUCN Red List of Threatened Species*™ is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarized below.

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX B

OBSERVED AND POTENTIAL VERTEBRATE FAUNA LISTING

Observed and Potential Vertebrate Fauna Listing

Capel Dry Plant, Capel - WA

Approx. centroid = 115.5683°E, 33.54503°S
Compiled by Greg Harewood - March 2018
Recorded (Captured/Sighted/Heard/Signs) = X

A = Harewood, G (2018). Fauna Assessment Capel Dry Plant. Unpublished report for Iluka Resources Ltd. May 2018.
B = Harewood, G (2013). Terrestrial Fauna Assessment (Level 1) Yoganup Extended Mineral Sands Project. Unpublished report for Iluka Resources Limited. March 2013.
Harewood, G (2017). Fauna Assessment Lot 3833 (Part) Hyder Road. Unpublished report for Iluka Resources Limited. February 2017.
C = Harewood, G (2014). Phase 1 and 2 Seasonal Fauna Surveys (Level 2) . Yoongarillup Mineral Sands Project. Unpublished report for Doral Mineral Sands Pty Ltd.
D = Biologic (2014). Wonnerup North Vertebrate Fauna Assessment. Unpublished report for Cristal Mining Australia Ltd. April 2014.
E = Biota (2009). Tutunup Fauna Assemblage and Fauna Habitat Seasonal Survey. Unpublished report for Iluka Resources. March 2009.
F = Harewood, G (2008). Fauna Assessment Survey - Lot 187 Stratham. Unpublished report for MBS Environmental. January 2008.
G = Biota (2007a). Yoganup 215 Strand Fauna and Faunal Assemblage Survey. Unpublished report for Iluka Resources. February 2007.
H = Biota (2007b). Tutunup South Fauna Habitat and Fauna Assemblage Seasonal Survey. Unpublished report for Iluka Resources. December 2007.
I = Bamford, M. and A. (2001). Fauna Survey of the Ludlow Mining Lease. Final Report. Unpublished report for Cable Sands (WA) Pty Ltd. November 2001
J = Hart, Simpson and Assoc. (1997). Wonnerup -Tutunup Road - Vertebrate Fauna. Unpublished report for Westralian Sands Ltd.
K = DBCA (2017). NatureMap Database search. “By Circle” 115° 34' 06" E, 33° 32' 42" S (plus 20km buffer). 19/12/2017.

Class / **Family** / *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Amphibia													
Myobatrachidae Ground or Burrowing Frogs													
Crinia georgiana	Quacking Frog	LC					X		X	X		X	X
Crinia glauerti	Clicking Frog	LC	X	X		X	X		X			X	X
Crinia insignifera	Squelching Froglet	LC			X	X	X	X	X	X	X	X	X
Geocrinia leai	Ticking Frog	LC											X
Heleioporus eyrei	Moaning Frog	LC		X	X	X	X	X	X	X	X	X	X
Limnodynastes dorsalis	Western Banjo Frog	LC			X	X		X		X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Hylidae Tree or Water-Holding Frogs													
Litoria adelaidensis	Slender Tree Frog	LC	X	X		X	X	X	X			X	X
Litoria moorei	Motorbike Frog	LC		X		X		X					X
Reptilia													
Gekkonidae Geckoes													
Christinus marmoratus	Marbled Gecko				X	X	X	X	X	X	X	X	X
Scincidae Skinks													
Acritoscincus trilineatum	Southwestern Cool Skink				X	X	X		X	X		X	
Cryptoblepharus buchananii	Fence Skink			X	X	X	X	X	X	X	X		X
Egernia kingii	King's Skink				X		X	X	X			X	X
Hemiergis gracilipes	Southwestern Mulch Skink								X				X
Hemiergis peronii tridactyla	Three-toed Earless Skink				X	X	X		X		X	X	
Hemiergis quadrilineata	Two-toed Mulch Skink							X					X
Lerista elegans	West Coast Four-toed Lerista				X	X	X	X	X	X	X		X
Menetia greyii	Dwarf Skink				X		X	X	X	X	X	X	X
Morethia lineoocellata	West Coast Pale-flecked Morethia				X		X	X	X	X	X	X	X
Tiliqua rugosa	Bobtail			X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Elapidae Elapid Snakes													
Notechis scutatus	Tiger Snake							X	X			X	X
Pseudonaja affinis	Dugite				X	X		X			X	X	X
Aves													
Phasianidae Quails, Pheasants													
Coturnix pectoralis	Stubble Quail	LC		X	X	X							X
Anatidae Geese, Swans, Ducks													
Anas gracilis	Grey Teal	LC		X		X			X			X	X
Anas superciliosa	Pacific Black Duck	LC	X	X		X	X		X			X	X
Chenonetta jubata	Australian Wood Duck	LC	X	X	X	X	X		X			X	X
Tadorna tadornoides	Australian Shelduck	LC		X	X	X	X				X	X	X
Phalacrocoracidae Cormorants													
Phalacrocorax melanoleucos	Little Pied Cormorant	LC		X									
Phalacrocorax sulcirostris	Little Black Cormorant	LC					X						X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Ardeidae Herons, Egrets, Bitterns													
Ardea alba	Great Egret	CA JA		X									
Ardea novaehollandiae	White-faced Heron	LC		X	X	X	X		X			X	
Ardea pacifica	White-necked Heron	LC		X		X							X
Threskiornithidae Iibises, Spoonbills													
Platalea flavipes	Yellow-billed Spoonbill	LC		X		X							X
Threskiornis molucca	Australian White Ibis	LC		X	X	X						X	
Threskiornis spinicollis	Straw-necked Ibis	LC	X	X	X	X	X		X			X	X
Accipitridae Kites, Goshawks, Eagles, Harriers													
Accipiter cirrocephalus	Collared Sparrowhawk	Bp LC			X						X		X
Accipiter fasciatus	Brown Goshawk	Bp LC		X				X		X	X		X
Aquila audax	Wedge-tailed Eagle	Bp LC			X	X	X	X	X		X	X	X
Aquila morphnoides	Little Eagle	Bp LC		X							X		
Circus approximans	Swamp Harrier	LC		X				X	X				X
Elanus caeruleus	Black-shouldered Kite	LC		X									
Haliastur sphenurus	Whistling Kite	Bp LC		X		X	X	X			X		X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Falconidae Falcons													
Falco berigora	Brown Falcon	Bp LC		X							X		X
Falco cenchroides	Australian Kestrel	LC		X	X	X		X	X				X
Falco longipennis	Australian Hobby	LC						X	X				X
Falco peregrinus	Peregrine Falcon	S7 Bp LC											X
Rallidae Rails, Crakes, Swamphens, Coots													
Fulica atra	Eurasian Coot	LC		X									X
Gallinula tenebrosa	Dusky Moorhen	Bh LC							X				X
Porphyrio porphyrio	Purple Swamphen	LC		X									X
Charadriidae Lapwings, Plovers, Dotterels													
Vanellus tricolor	Banded Lapwing	LC		X									X
Columbidae Pigeons, Doves													
Columba livia	Domestic Pigeon	Introduced											X
Ocyphaps lophotes	Crested Pigeon	LC		X	X	X	X		X			X	X
Phaps chalcoptera	Common Bronzewing	Bh LC	X	X	X	X	X	X	X	X	X	X	X
Streptopelia senegalensis	Laughing Turtle-Dove	Introduced							X				X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Psittacidae Parrots													
Cacatua roseicapilla	Galah	LC	X	X				X					X
Cacatua sanguinea	Little Corella	LC		X									X
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3 VU Be	X	X	X		X	X	X	X		X	X
Calyptorhynchus baudinii	Baudin's Black Cockatoo	S2 EN Bp EN A3cde	X	X	X	X	X		X			X	X
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	S2 EN Bp EN A2bcde		X	X	X	X	X	X	X	X	X	X
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC			X					X			
Neophema elegans	Elegant Parrot	LC		X	X	X	X		X	X			X
Platycercus icterotis icterotis	Western Rosella (western ssp)	Bp LC					X		X		X		
Platycercus spurius	Red-capped Parrot	LC	X	X	X	X	X	X	X	X	X	X	X
Platycercus zonarius	Australian Ringneck	LC	X	X	X	X	X	X	X	X	X	X	X
Polytelis anthopeplus	Regent Parrot	LC				X		X	X		X	X	X
Cuculidae Parasitic Cuckoos													
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC					X	X			X	X	X
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC					X		X				X
Chrysococcyx lucidus	Shining Bronze Cuckoo	LC	X		X		X		X		X	X	X
Cuculus pallidus	Pallid Cuckoo	LC		X			X					X	

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Strigidae Hawk Owls													
Ninox novaeseelandiae	Boobook Owl	LC		X	X	X	X				X		
Tytonidae Barn Owls													
Tyto alba	Barn Owl	LC		X									X
Podargidae Frogmouths													
Podargus strigoides	Tawny Frogmouth	LC		X			X				X		X
Halcyonidae Tree Kingfishers													
Dacelo novaeguineae	Laughing Kookaburra	Introduced		X	X	X	X	X	X	X	X	X	X
Todiramphus sanctus	Sacred Kingfisher	LC					X				X	X	X
Meropidae Bee-eaters													
Merops ornatus	Rainbow Bee-eater	JA LC		X	X	X	X	X	X	X	X	X	X
Maluridae Fairy Wrens, GrassWrens													
Malurus splendens	Splendid Fairy-wren	Bh LC	X	X	X	X	X	X	X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces													
Acanthiza apicalis	Broad-tailed Thornbill	Bh LC		X	X		X	X	X	X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Bh LC		X	X	X	X	X	X		X	X	X
Gerygone fusca	Western Gerygone	LC	X	X	X	X	X	X	X	X	X	X	X
Sericornis frontalis	White-browed Scrubwren	Bh LC			X	X	X	X	X	X	X		X
Smicrornis brevirostris	Weebill	Bh LC	X	X	X		X	X		X	X		X
Pardalotidae Pardalotes													
Pardalotus punctatus	Spotted Pardalote	LC					X		X		X		X
Pardalotus striatus	Striated Pardalote	LC	X	X	X	X	X	X	X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Meliphagidae Honeyeaters, Chats													
Anthochaera carunculata	Red Wattlebird	LC	X	X	X	X		X	X	X	X	X	X
Anthochaera lunulata	Western Little Wattlebird	Bp LC		X									X
Epthianura albifrons	White-fronted Chat	LC							X				X
Lichenostomus virescens	Singing Honeyeater	LC					X			X			
Lichmera indistincta	Brown Honeyeater	LC	X	X	X	X	X		X	X	X	X	X
Phylidonyris nigra	White-cheeked Honeyeater	Bp LC							X				
Phylidonyris novaehollandiae	New Holland Honeyeater	Bp LC	X	X	X	X	X		X	X		X	X
Petroicidae Australian Robins													
Petroica multicolor	Scarlet Robin	Bh LC		X	X	X	X	X	X	X	X		
Neosittidae Sitellas													
Daphoenositta chrysoptera	Varied Sittella	Bh LC			X		X		X		X		X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers													
Pachycephala pectoralis	Golden Whistler	Bh LC		X	X	X	X	X	X	X	X		
Pachycephala rufiventris	Rufous Whistler	LC	X	X	X		X	X	X		X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo													
Grallina cyanoleuca	Magpie-lark	LC		X	X	X		X	X			X	X
Rhipidura fuliginosa	Grey Fantail	LC	X	X	X	X	X	X	X	X	X	X	
Rhipidura leucophrys	Willie Wagtail	LC	X	X	X	X	X	X	X	X	X	X	X
Campephagidae Cuckoo-shrikes, Trillers													
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC		X	X	X	X	X	X	X	X	X	X
Lalage tricolor	White-winged Triller	LC		X									X
Artamidae Woodswallows, Butcherbirds, Currawongs													
Artamus cinereus	Black-faced Woodswallow	Bp LC		X				X	X		X	X	X
Artamus cyanopterus	Dusky Woodswallow	Bp LC		X			X		X	X			X
Cracticidae Currawongs, Magpies & Butcherbirds													
Cracticus tibicen	Australian Magpie	LC		X	X	X	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X	X	X	X	X	X		X	X	X
Corvidae Ravens, Crows													
Corvus coronoides	Australian Raven	LC		X	X	X	X	X	X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Motacillidae Old World Pipits, Wagtails													
Anthus australis	Australian Pipit	LC		X	X	X	X		X				
Dicaeidae Flowerpeckers													
Dicaeum hirundinaceum	Mistletoebird	LC											X
Hirundinidae Swallows, Martins													
Hirundo ariel	Fairy Martin	LC		X									
Hirundo neoxena	Welcome Swallow	LC		X	X	X		X	X	X		X	X
Hirundo nigricans	Tree Martin	LC	X	X	X	X	X	X	X			X	
Sylviidae Old World Warblers													
Acrocephalus australis	Australian Reed Warbler	LC											X
Cincloramphus cruralis	Brown Songlark	LC			X								
Cincloramphus mathewsi	Rufous Songlark	LC										X	
Megalurus gramineus	Little Grassbird	LC											X
Zosteropidae White-eyes													
Zosterops lateralis	Silvereye	LC	X	X			X	X	X	X	X	X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Mammalia													
Peramelidae Bandicoots													
Isoodon fusciventer	Quenda	P4 LC		X	X		X		X	X	X	X	X
Phalangeridae Brushtail Possums, Cuscuses													
Trichosurus vulpecula	Common Brushtail Possum	LC	X	X	X	X	X	X	X	X	X	X	X
Pseudocheiridae Ringtail Posssums													
Pseudocheirus occidentalis	Western Ringtail Possum	S1 VU CR A2bce+3bce+4bc	X	X		X	X	X			X		X
Molossidae Freetail Bats													
Austronomus australis	White-striped Freetail-bat	LC		X	X	X			X	X	X		
Ozimops kitcheneri	South-western Freetail-bat	LC			X	X							

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Vespertilionidae Ordinary Bats													
Chalinolobus gouldii	Gould's Wattled Bat	LC			X	X	X	X					
Chalinolobus morio	Chocolate Wattled Bat	LC			X	X	X			X			
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC			X	X	X	X					
Nyctophilus gouldi	Gould's Long-eared Bat	LC				X		X		X	X		
Nyctophilus major	Western Long-eared Bat	LC									X		
Vespadelus regulus	Southern Forest Bat	LC			X	X	X	X	X	X			X
Muridae Rats, Mice													
Mus musculus	House Mouse	Introduced			X	X	X		X		X	X	X
Rattus rattus	Black Rat	Introduced			X	X	X	X			X		X
Canidae Dogs, Foxes													
Vulpes vulpes	Red Fox	Introduced	X	X	X	X	X	X			X	X	X
Felidae Cats													
Felis catus	Cat	Introduced		X		X	X	X			X		
Leporidae Rabbits, Hares													
Oryctolagus cuniculus	Rabbit	Introduced		X	X	X	X	X	X	X	X	X	X

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APPENDIX C

DBCA & EPBC ACT DATABASE SEARCH RESULTS

NatureMap
Mapping Western Australia's biodiversity

NatureMap - Capel Dry Plant

Created By Greg Harewood on 12/03/2018

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 34' 06" E,33° 32' 42" S
Buffer 20km
Group By Species Group

Species Group	Species	Records
Amphibian	11	110
Bird	188	9892
Fish	38	102
Invertebrate	179	792
Mammal	34	1732
Reptile	35	223
TOTAL	**485**	**12851**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amphibian					
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25400	*Crinia insignifera (Squelching Froglet)*			
4.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
5.	25404	*Geocrinia leai (Ticking Frog)*			
6.	25410	*Heleioporus eyrei (Moaning Frog)*			
7.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
8.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
9.	25388	*Litoria moorei (Motorbike Frog)*			
10.	25419	*Metacrinia nichollsi (Forest Toadlet)*			
11.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Bird					
12.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
13.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
14.	24262	*Acanthiza inornata (Western Thornbill)*			
15.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
16.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
17.	25536	*Accipiter fasciatus (Brown Goshawk)*			
18.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
19.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
20.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
21.	24301	*Aegotheles cristatus subsp. cristatus (Australian Owlet-nightjar)*			
22.	24310	*Anas castanea (Chestnut Teal)*			
23.	24312	*Anas gracilis (Grey Teal)*			
24.	24313	*Anas platyrhynchos (Mallard)*			
25.	24315	*Anas rhynchotis (Australasian Shoveler)*			
26.	24316	*Anas superciliosa (Pacific Black Duck)*			
27.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
28.	24561	*Anthochaera carunculata (Red Wattlebird)*			
29.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
30.	24285	*Aquila audax (Wedge-tailed Eagle)*			
31.	25558	*Ardea ibis (Cattle Egret)*		IA	
32.	41324	*Ardea modesta (great egret, white egret)*		IA	
33.	24341	*Ardea pacifica (White-necked Heron)*			
34.	24610	*Ardeotis australis (Australian Bustard)*			
35.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
36.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
37.	24318	*Aythya australis (Hardhead)*			
38.		*Barnardius zonarius*			
39.	24319	*Biziura lobata (Musk Duck)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
40.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
41.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
42.	25715	*Cacatua roseicapilla (Galah)*			
43.	25716	*Cacatua sanguinea (Little Corella)*			
44.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
45.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
46.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
47.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
48.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
49.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
50.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
51.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)*		T	
52.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
53.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
54.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		IA	
55.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
56.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
57.		*Chroicocephalus novaehollandiae*			
58.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
59.	25601	*Chrysococcyx lucidus (Shining Bronze Cuckoo)*			
60.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
61.		*Circus aeruginosus*			Y
62.	24288	*Circus approximans (Swamp Harrier)*			
63.	24289	*Circus assimilis (Spotted Harrier)*			
64.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
65.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
66.	24399	*Columba livia (Domestic Pigeon)*	Y		
67.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
68.	25592	*Corvus coronoides (Australian Raven)*			
69.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
70.	24671	*Coturnix pectoralis (Stubble Quail)*			
71.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
72.	25595	*Cracticus tibicen (Australian Magpie)*			
73.		*Cracticus torquartus*			
74.	25596	*Cracticus torquatus (Grey Butcherbird)*			
75.	24322	*Cygnus atratus (Black Swan)*			
76.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
77.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
78.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
79.	25618	*Diomedea exulans (Wandering Albatross)*		T	
80.	24470	*Dromaius novaehollandiae (Emu)*			
81.		*Egretta garzetta*			
82.		*Egretta novaehollandiae*			
83.		*Elanus axillaris*			
84.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
85.		*Eolophus roseicapillus*			
86.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
87.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
88.	24567	*Epthianura albifrons (White-fronted Chat)*			
89.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
90.	24368	*Eurostopodus argus (Spotted Nightjar)*			
91.	25621	*Falco berigora (Brown Falcon)*			
92.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
93.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
94.	25623	*Falco longipennis (Australian Hobby)*			
95.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
96.	24616	*Falcunculus frontatus subsp. leucogaster (Western Shrike-tit, Crested Shrike-tit)*			
97.	25727	*Fulica atra (Eurasian Coot)*			
98.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
99.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
100.	42314	*Gavicalis virescens (Singing Honeyeater)*			
101.	25530	*Gerygone fusca (Western Gerygone)*			
102.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
103.	24443	*Grallina cyanoleuca (Magpie-lark)*			
104.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
105.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
106.	24295	*Haliastur sphenurus (Whistling Kite)*			
107.	47965	*Hieraaetus morphnoides (Little Eagle)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
108.	25734	*Himantopus himantopus (Black-winged Stilt)*			
109.	24491	*Hirundo neoxena (Welcome Swallow)*			
110.		*Hydroprogne caspia*			
111.	24347	*Ixobrychus flavicollis subsp. australis (black bittern (southwest), Australian Black Bittern)*		P1	
112.	24367	*Lalage tricolor (White-winged Triller)*			
113.	25638	*Larus pacificus (Pacific Gull)*			
114.	25661	*Lichmera indistincta (Brown Honeyeater)*			
115.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
116.		*Lophoictinia isura*			
117.	24690	*Macronectes giganteus (Southern Giant Petrel)*		IA	
118.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
119.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
120.	25654	*Malurus splendens (Splendid Fairy-wren)*			
121.	24552	*Malurus splendens subsp. splendens (Splendid Fairy-wren)*			
122.	25758	*Megalurus gramineus (Little Grassbird)*			
123.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
124.		*Microcarbo melanoleucos*			
125.	25610	*Myiagra inquieta (Restless Flycatcher)*			
126.	24738	*Neophema elegans (Elegant Parrot)*			
127.	24739	*Neophema petrophila (Rock Parrot)*			
128.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
129.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
130.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
131.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
132.		*Pachycephala sp.*			Y
133.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
134.	24693	*Pachyptila desolata (Antarctic Prion)*			
135.		*Pandion cristatus*			
136.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
137.	24626	*Pardalotus punctatus subsp. xanthopyge (Yellow-rumped Pardalote)*			
138.	25682	*Pardalotus striatus (Striated Pardalote)*			
139.	24630	*Pardalotus striatus subsp. westraliensis (Striated Pardalote)*			
140.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
141.	48061	*Petrochelidon nigricans (Tree Martin)*			
142.	48066	*Petroica boodang (Scarlet Robin)*			
143.	25697	*Phalacrocorax carbo (Great Cormorant)*			
144.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
145.	25699	*Phalacrocorax varius (Pied Cormorant)*			
146.	24668	*Phalacrocorax varius subsp. hypoleucos (Pied Cormorant)*			
147.	24409	*Phaps chalcoptera (Common Bronzewing)*			
148.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
149.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
150.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
151.	24842	*Platalea regia (Royal Spoonbill)*			
152.	25720	*Platycercus icterotis (Western Rosella)*			
153.	24745	*Platycercus icterotis subsp. icterotis (Western Rosella)*			
154.	24747	*Platycercus spurius (Red-capped Parrot)*			
155.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
156.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
157.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
158.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
159.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
160.	25703	*Podargus strigoides (Tawny Frogmouth)*			
161.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
162.	25704	*Podiceps cristatus (Great Crested Grebe)*			
163.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
164.	25722	*Polytelis anthopeplus (Regent Parrot)*			
165.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
166.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
167.	24769	*Porzana fluminea (Australian Spotted Crake)*			
168.	25732	*Porzana pusilla (Baillon's Crake)*			
169.	24771	*Porzana tabuensis (Spotless Crake)*			
170.	24703	*Pterodroma lessonii (White-headed Petrel)*			
171.	25710	*Pterodroma macroptera (Great-winged Petrel)*			
172.		*Purpureicephalus spurius*			
173.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
174.	48096	*Rhipidura albiscapa (Grey Fantail)*			
175.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
176.	25534	*Sericornis frontalis (White-browed Scrubwren)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
177.	24279	*Sericornis frontalis subsp. maculatus (White-browed Scrubwren)*			
178.	30948	*Smicrornis brevirostris (Weebill)*			
179.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
180.	24329	*Stictonetta naevosa (Freckled Duck)*			
181.	25655	*Stipiturus malachurus (Southern Emu-wren)*			
182.	25597	*Strepera versicolor (Grey Currawong)*			
183.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
184.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
185.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
186.	34134	*Thalassarche carteri (Indian Yellow-nosed Albatross)*		T	
187.		*Thalasseus bergii*			
188.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
189.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
190.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
191.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
192.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
193.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
194.	48147	*Turnix varius (Painted Button-quail)*			
195.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
196.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southwest))*		P3	
197.	25577	*Vanellus miles (Masked Lapwing)*			
198.	24386	*Vanellus tricolor (Banded Lapwing)*			
199.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Fish

200.		*? ?*			
201.		*Acanthaluteres brownii*			
202.		*Acanthaluteres spilomelanurus*			
203.		*Acanthaluteres vittiger*			
204.		*Apogon rueppellii*			
205.		*Aseraggodes haackeanus*			
206.		*Atherinosoma sp.*			
207.		*Bostockia porosa*			
208.		*Brachaluteres jacksonianus*			
209.		*Cantheschenia longipinnis*			
210.		*Carassius auratus*			
211.		*Cochleoceps viridis*			
212.		*Coryphaena hippurus*			
213.		*Cristiceps australis*			
214.		*Dotalabrus aurantiacus*			
215.		*Echeneis naucrates*			
216.		*Edelia vittata*			
217.		*Eubalichthys cyanoura*			
218.	34028	*Galaxias occidentalis (Western Minnow)*			
219.		*Gambusia affinis*			
220.		*Gambusia holbrooki*			
221.	34030	*Geotria australis (Pouched Lamprey)*		P1	
222.		*Gymnapistes marmoratus*			
223.		*Haletta semifasciata*			
224.		*Heteroclinus adelaidae*			
225.		*Heteroclinus sp.*			
226.		*Meuschenia freycineti*			
227.		*Meuschenia galii*			
228.		*Nannoperca vittata*			
229.		*Perca fluviatilis*			
230.		*Posidonichthys hutchinsi*			
231.		*Pseudogobius olorum*			
232.		*Scobinichthys granulatus*			
233.		*Siphamia cephalotes*			
234.		*Siphonognathus radiatus*			
235.		*Stigmatopora argus*			
236.		*Thunnus maccoyii*			
237.		*Vanacampus poecilolaemus*			

Invertebrate

238.		*Acariformes sp.*			
239.		*Acarina sp.*			
240.		*Aeshnidae sp.*			
241.		*Aganippe rhaphiduca*			
242.		*Akamptogonus novarae*			
243.		*Allothereua maculata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
244.		*Amblyomma albolimbatum*			
245.		*Aname mainae*			
246.		*Aname tepperi*			
247.		*Ancylidae sp.*			
248.		*Anisops sp.*			
249.		*Antichiropus nanus*			
250.		*Antiporus femoralis*			
251.		*Antiporus sp.*			
252.		*Arachnura higginsi*			
253.		*Araneus cyphoxis*			
254.		*Araneus eburneiventris*			
255.		*Araneus recherchensis*			
256.		*Araneus senicaudatus*			
257.		*Argiope protensa*			
258.		*Argiope trifasciata*			
259.		*Arkys alticephala*			
260.		*Arkys walckenaeri*			
261.		*Arrenuridae sp.*			
262.		*Artoria flavimana*			
263.		*Artoriopsis expolita*			
264.		*Athericidae sp.*			
265.		*Aturidae sp.*			
266.		*Austracantha minax*			
267.		*Austrochthonius strigosus*			Y
268.		*Backobourkia brounii*			
269.		*Badumna insignis*			
270.		*Baetidae sp.*			
271.		*Baiami volucripes*			
272.		*Berosus discolor*			
273.		*Berosus munitipennis*			
274.	47873	*Bertmainius opimus (western pygmy trapdoor spider)*		P3	
275.		*Botryocladius freemani*			
276.		*Caenidae sp.*			
277.		*Ceinidae sp.*			
278.		*Celaenia excavata*			
279.		*Ceratopogonidae sp.*			
280.		*Cercophonius sulcatus*			
281.		*Cherax destructor*			
282.		*Cherax preissii*			
283.		*Cherax quinquecarinatus*			
284.		*Chironominae sp.*			
285.		*Chironomus aff. alternans (V24) (CB)*			
286.		*Chironomus tepperi*			
287.		*Chrysomelidae sp.*			
288.		*Clynotis severus*			
289.		*Coenagrionidae sp.*			
290.		*Copepoda sp.*			
291.		*Corduliidae sp.*			
292.		*Corixidae sp.*			
293.		*Cormocephalus hartmeyeri*			
294.		*Corynoneura sp. (V49) (SAP)*			
295.		*Cricotopus 'parbicinctus'*			
296.		*Cryptoerithus quobba*			
297.		*Culex (Culex) australicus*			
298.		*Culicidae sp.*			
299.		*Cyclosa trilobata*			
300.		*Cyrtophora parnasia*			
301.		*Dicrotendipes sp. A (V47) (SAP)*			
302.		*Dingosa serrata*			
303.		*Dugesiidae sp.*			
304.		*Dytiscidae sp.*			
305.		*Ecnomidae sp.*			
306.		*Eriophora biapicata*			
307.		*Eriophora pustulosa*			
308.		*Gelastocoridae sp.*			
309.		*Geogarypus taylori*			
310.		*Gomphidae sp.*			
311.		*Gripopterygidae sp.*			
312.		*Gyrinidae sp.*			
313.		*Harrisius sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
314.		*Harrisius sp. B (SFM)*			
315.		*Helochares tenuistriatus*			
316.		*Helpis minitabunda*			
317.		*Hemicorduliidae sp.*			
318.		*Henicops dentatus*			
319.		*Heurodes turritus*			
320.		*Hydraenidae sp.*			
321.		*Hydrobiosidae sp.*			
322.		*Hydrophilidae sp.*			
323.		*Hydroptilidae sp.*			
324.		*Hyriidae sp.*			
325.		*Insulodrilus bifidus*			
326.		*Isopeda leishmanni*			
327.		*Isopedella cana*			
328.		*Isopedella castanea*			
329.		*Kiefferulus intertinctus*			
330.		*Lampona cylindrata*			
331.		*Lampona punctigera*			
332.		*Lancetes lanceolatus*			
333.		*Latrodectus hasseltii*			
334.		*Leptoceridae sp.*			
335.		*Leptoperla australica*			
336.		*Leptophlebiid genus S sp. AV1*			
337.		*Leptophlebiidae sp.*			
338.		*Lestidae sp.*			
339.		*Libellulidae sp.*			
340.		*Limbodessus inornatus*			
341.		*Limnophyes vestitus (V41)*			
342.		*Limnoxenus zelandicus*			
343.		*Maratus pavonis*			
344.		*Megapodagrionidae sp.*			
345.		*Micronecta robusta*			
346.		*Microvelia sp.*			
347.		*Missulena granulosa*			
348.		*Missulena occatoria*			
349.		*Mituliodon tarantulinus*			
350.		*Mitzoruga insularis*			
351.		*Nephila edulis*			
352.		*Newmanoperla exigua*			
353.		*Nicodamus mainae*			
354.		*Notonectidae sp.*			
355.		*Nousia sp. AV16*			
356.		*Nunciella aspera*			
357.		*Ocrisiona parmeliae*			
358.		*Oligochaeta sp.*			
359.		*Ommatoiulus moreletii*			
360.		*Opisthopora sp.*			
361.		*Oratemnus curtus*			
362.		*Orthocladiinae sp.*			
363.		*Ostracoda (unident.)*			
364.		*Palaemonidae sp.*			
365.		*Paracymus sp.*			
366.		*Paracymus spenceri*			
367.		*Parakiefferiella variegatus*			
368.		*Paralimnophyes pullulus (V42)*			
369.		*Paramelitidae sp.*			
370.		*Paramerina levidensis*			
371.		*Parastacidae sp.*			
372.		*Pentaneurini genus V20*			
373.		*Perthiidae sp.*			
374.		*Philopotamidae sp.*			
375.		*Pholcus phalangioides*			
376.		*Phreatoicidae sp.*			
377.		*Phreodrilidae sp.*			
378.		*Planorbidae sp.*			
379.		*Platorish gelorup*			
380.		*Platynectes decempuntatus var polygrammus*			
381.		*Platynectes sp.*			
382.		*Polypedilum nr. convexum (SAP)*			
383.		*Polypedilum watsoni*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
384.		*Protoneuridae sp.*			
385.		*Pyralidae sp.*			
386.		*Raveniella peckorum*			
387.		*Rhantus sp.*			
388.		*Rhantus suturalis*			
389.		*Richardsonianidae sp.*			
390.		*Riethia v5*			
391.		*Scirtidae sp.*			
392.		*Simuliidae sp.*			
393.		*Staphylinidae sp.*			
394.		*Sternopriscus browni*			
395.		*Sternopriscus sp.*			
396.		*Synthemistidae sp.*			
397.		*Tabanidae sp.*			
398.		*Tamopsis distinguenda*			
399.		*Tamopsis perthensis*			
400.		*Tanypodinae sp.*			
401.		*Tanytarsus nr K5*			
402.		*Tanytarsus palmatus*			
403.		*Tanytarsus sp.*			
404.		*Tasmanicosa leuckartii*			
405.		*Telephlebiidae sp.*			
406.		*Temnocephalidea sp.*			
407.		*Tetragnatha demissa*			
408.		*Tipulidae sp.*			
409.		*Triplectides sp. AV21 (SFM)*			
410.		*Trombidioidea sp.*			
411.		*Urodacus novaehollandiae*			
412.		*Uvarus pictipes*			
413.		*Venator immansueta*			
414.		*Venatrix pullastra*			
415.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
416.		*Zachria flavicoma*			

Mammal

417.	24209	*Arctocephalus tropicalis (Subantarctic fur-seal)*		T	
418.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
419.	24251	*Bos taurus (European Cattle)*	Y		
420.	24072	*Caperea marginata (Pygmy Right Whale)*			
421.	24086	*Cercartetus concinnus (Western Pygmy-possum, Mundarda)*			
422.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
423.	24043	*Eubalaena australis (Southern Right Whale)*		T	
424.	24189	*Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)*		P4	
425.	24056	*Grampus griseus (Risso's Dolphin)*			
426.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
427.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P4	
428.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P4	
429.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
430.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
431.	24168	*Macrotis lagotis (Bilby, Dalgyte)*		T	
432.	24051	*Megaptera novaeangliae (Humpback Whale)*		S	
433.	24076	*Mesoplodon bowdoini (Andrew's Beaked Whale)*			
434.	24078	*Mesoplodon grayi (Gray's Beaked Whale)*			
435.	24213	*Mirounga leonina (Southern Elephant Seal)*			
436.	24223	*Mus musculus (House Mouse)*	Y		
437.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
438.	25508	*Phascogale tapoatafa (Brush-tailed Phascogale)*			
439.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		T	
440.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
441.	24240	*Pseudomys occidentalis (Western Mouse)*		P4	
442.	24245	*Rattus rattus (Black Rat)*	Y		
443.	24145	*Setonix brachyurus (Quokka)*		T	
444.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
445.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
446.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
447.	30954	*Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)*			
448.	24069	*Tursiops truncatus (Bottlenose Dolphin)*			
449.	24206	*Vespadelus regulus (Southern Forest Bat)*			
450.	24040	*Vulpes vulpes (Red Fox)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Reptile					
451.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
452.	44629	*Anilios australis*			
453.	24990	*Aprasia pulchella (Granite Worm-lizard)*			
454.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
455.	25336	*Chelonia mydas (Green Turtle)*		T	
456.	24980	*Christinus marmoratus (Marbled Gecko)*			
457.	30893	*Cryptoblepharus buchananii*			
458.	25020	*Cryptoblepharus plagiocephalus*			
459.	25047	*Ctenotus impar*			
460.	25049	*Ctenotus labillardieri*			
461.	25096	*Egernia kingii (King's Skink)*			
462.	25100	*Egernia napoleonis*			
463.	25250	*Elapognathus coronatus (Crowned Snake)*			
464.	30919	*Hemiergis gracilipes*			
465.	25475	*Hemiergis peronii*			
466.	25118	*Hemiergis peronii subsp. tridactyla*			
467.	25119	*Hemiergis quadrilineata*			
468.	43384	*Hydrophis platurus (Yellow-bellied Seasnake)*			
469.	25131	*Lerista distinguenda*			
470.	25133	*Lerista elegans*			
471.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
472.	25005	*Lialis burtonis*			
473.	42413	*Lissolepis luctuosa (Western Swamp Skink)*			
474.	25184	*Menetia greyii*			
475.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
476.	25191	*Morethia lineoocellata*			
477.	25252	*Notechis scutatus (Tiger Snake)*			
478.	25255	*Parasuta nigriceps*			
479.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
480.	25511	*Pseudonaja affinis (Dugite)*			
481.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
482.	25519	*Tiliqua rugosa*			
483.	25207	*Tiliqua rugosa subsp. rugosa*			
484.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
485.	25225	*Varanus rosenbergi (Heath Monitor)*			

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

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

Australian Government
Department of the Environment and Energy

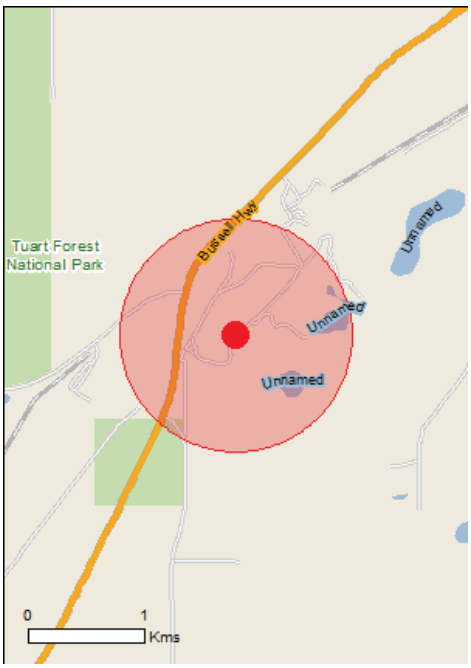
EPBC Act Protected Matters Report

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

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

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

Report created: 12/03/18 13:23:01



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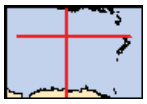

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	25
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	21
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Vasse-wonnerup system	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		

Name	Status	Type of Presence
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat likely to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat likely to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur

Name	Status	Type of Presence within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.57899 115.52887

Acknowledgements

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

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

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

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

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX D

BLACK COCKATOO HABITAT TREE DETAILS

Habitat Trees
DBH >50cm
Datum - GDA94
Entrance Size Ranges - Small = >5cm, Medium = 5, 10cm, Large = >10cm

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Sizes	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt002	50H	367005	6287311	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt003	50H	367013	6287294	Marri	15-20	0		No Signs	No Signs	No	
wpt005	50H	367037	6287325	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt007	50H	367061	6287321	Unknown Euc	15-20	0		No Signs	No Signs	No	Planted
wpt009	50H	367086	6287330	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt010	50H	367083	6287338	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt011	50H	367091	6287337	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt013	50H	367112	6287345	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt014	50H	367120	6287333	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt015	50H	367122	6287327	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt019	50H	367147	6287321	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt020	50H	367133	6287331	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt021	50H	367054	6287345	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt022	50H	367019	6287351	Marri	15-20	0		No Signs	No Signs	No	
wpt023	50H	366997	6287348	Tuart	15-20	0		No Signs	No Signs	No	Planted
wpt024	50H	367006	6287335	Tuart	15-20	0		No Signs	No Signs	No	Planted
wpt025	50H	367039	6287344	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt027	50H	367058	6287361	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt029	50H	367027	6287442	Marri	20+	0		No Signs	No Signs	No	
wpt030	50H	367009	6287434	Marri	20+	0		No Signs	No Signs	No	
wpt031	50H	367016	6287403	Marri	20+	0		No Signs	No Signs	No	
wpt032	50H	367013	6287390	Marri	20+	0		No Signs	No Signs	No	
wpt033	50H	367075	6287245	Unknown Euc	15-20	0		No Signs	No Signs	No	Planted
wpt034	50H	367072	6287237	Unknown Euc	15-20	0		No Signs	No Signs	No	Planted
wpt035	50H	367074	6287228	Unknown Euc	15-20	0		No Signs	No Signs	No	Planted

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Sizes	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt101	50H	367096	6287256	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt103	50H	367112	6287270	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt104	50H	367118	6287280	Tuart	20+	0		No Signs	No Signs	No	Planted
wpt105	50H	367146	6287292	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt106	50H	366961	6287338	Dead Marri	15-20	2+	Small-Medium	No Signs	No Signs	No	Depth of hollows unknown
wpt107	50H	366956	6287348	Marri	20+	0		No Signs	No Signs	No	
wpt108	50H	366952	6287349	Marri	20+	0		No Signs	No Signs	No	
wpt109	50H	366951	6287349	Marri	20+	0		No Signs	No Signs	No	
wpt110	50H	366955	6287377	Dead Marri	20+	2+	Small-Medium	No Signs	No Signs	No	Roost site for Ibis
wpt111	50H	366954	6287384	Dead Marri	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Depth of hollows unknown
wpt112	50H	366959	6287383	Dead Marri	15-20	0		No Signs	No Signs	No	
wpt113	50H	366949	6287385	Marri	15-20	0		No Signs	No Signs	No	
wpt114	50H	366948	6287391	Marri	15-20	0		No Signs	No Signs	No	
wpt115	50H	366963	6287394	Dead Unknown	20+	2+	Small	No Signs	No Signs	No	Depth of hollows unknown
wpt116	50H	366959	6287406	Marri	20+	0		No Signs	No Signs	No	
wpt117	50H	366962	6287407	Marri	20+	0		No Signs	No Signs	No	
wpt118	50H	366962	6287424	Marri	15-20	0		No Signs	No Signs	No	
wpt119	50H	366956	6287457	Marri	20+	0		No Signs	No Signs	No	
wpt120	50H	366959	6287458	Marri	15-20	0		No Signs	No Signs	No	
wpt121	50H	366968	6287465	Marri	15-20	0		No Signs	No Signs	No	
wpt122	50H	366980	6287352	Marri	15-20	0		No Signs	No Signs	No	
wpt123	50H	366953	6287329	Marri	15-20	0		No Signs	No Signs	No	
wpt124	50H	366955	6287333	Marri	20+	0		No Signs	No Signs	No	
wpt125	50H	366958	6287325	Dead Unknown	10-15	2+	Small-Medium	No Signs	No Signs	No	Possible drey in hollow
wpt126	50H	366975	6287310	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt127	50H	366910	6287259	Unknown Euc	20+	0		No Signs	No Signs	No	Planted
wpt131	50H	366934	6287372	Marri	15-20	0		No Signs	No Signs	No	
wpt132	50H	366931	6287396	Marri	15-20	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Sizes	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt133	50H	366925	6287399	Flooded Gum	10-15	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Depth of hollows unknown
wpt134	50H	366908	6287466	Unknown Euc	20+	0		No Signs	No Signs	No	Planted

DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

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Appendix C Certificates of Title

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S R Hutton WSL - 71

DATED 4th February 1924

Capel Suburban Lot 56

A.	R.	P.
7	0	32

GRANT

TO

William Walter Hutton

FEE PAID 6/3088 5/7

162

ENTERED ON RECORD this 4th

day of February 1924

INDEXED

Land

Permit

Lease

[signature]

for Minister for Lands.

CERTIFICATE made out in conformity with 56th Vict., No. 14, Section 18, and registered.

Vol. 850 Folio 162

Date 5. 2. 24

[signature]

Asst. Registrar of Titles

Examined by

q 4395/23 *

p/o ...ian Lands Parliament Place West Perth 6005

Post

46194

171437

Primary Security Mortgage Stamped to secure £1000. Instrument stamped 2/6
Mortgage 6591/1924. William Walter Hutton to The Union Bank of Australia Limited to secure £905-9-5 and further advances and interest as therein. Registered 8th September 1924 at 2.40 o'clock.

DISCHARGED

A Barnall
ASSISTANT REGISTRAR OF TITLES.

Discharge 2157/1931 of Mortgage 6591/1924 Registered 18th August 1931 at 11-5 o'c

Arthur Lowry
ASSISTANT REGISTRAR OF TITLES.

Mortgage 6257/1931 William Walter Hutton to Rose Elizabeth Mary Walker of Picton Crescent Bunbury Married Woman to secure £550 Registered 18th August 1931 at 11.5 o'c

DISCHARGED

Arthur Lowry
ASSISTANT REGISTRAR OF TITLES.

Collateral to Mortgage Stamped 7/6
Mortgage 4731/1933 William Walter Hutton to Newton James Moore of 16 Northumberland Avenue London England Gentleman Registered 23rd October 1933 at 12-30 o'c.

DISCHARGED

Arthur Lowry
ASSISTANT REGISTRAR OF TITLES.

Discharge 4164/1935 of Mortgage 6257/1931 Registered 25th October 1935 at 10 o'clock.

Arthur Bleadell
ASSISTANT REGISTRAR OF TITLES.

Discharge 4165/1935 of Mortgage 4731/1933. Registered 25th October 1935 at 10 o'clock.

Arthur Bleadell
ASSISTANT REGISTRAR OF TITLES.

Instrument stamped £1.5.0
Mortgage 5670/1935 William Walter Hutton to The Union Bank of Australia Limited.
Registered 25th October 1935 at 10 o'clock.

DISCHARGED

Arthur Bleadell
ASSISTANT REGISTRAR OF TITLES.

Collateral to mortgage stamped £1.5.0 Instrument primarily stamped 1/6
Mortgage 3352/1936 William Walter Hutton to The Union Bank of Australia Limited Registered 2nd July 1936 at 3 o'clock

DISCHARGED

Cecil Garratt
ASSISTANT REGISTRAR OF TITLES

Collateral to mortgages stamped together £1.17.6 Instrument primarily stamped 15/-
Mortgage 468/1937 William Walter Hutton to The Union Bank of Australia Limited Registered 2nd February 1937 at 12 o'c

DISCHARGED

A Barnall
ASSISTANT REGISTRAR OF TITLES.

DISCHARGE 14/1952 of Mortgage 5640/1935
Registered 2nd January 1952 at 11-45 o'c
J A Blott
Assistant Registrar of Titles.

DISCHARGE 19/1952 of Mortgage 3352/1936
Registered 2nd January 1952 at 11-45 o'c
J A Blott
Assistant Registrar of Titles.

DISCHARGE 20/1952 of Mortgage 468/1937.
Registered 2nd January 1952 at 11-45 o'c
J A Blott
Assistant Registrar of Titles.

Charge 16/1952 charges the within land with the payment of an annuity as therein to William Walter Hutton of Capel, Farmer.
Registered 8th April 1952 at 9 o'c

DISCHARGED

A Buchanan
REGISTRAR OF TITLES

Discharge 64794/65 of Charge 16/1952
Registered 17th September 1965 at 9.11 o'c
L.F. Symes
ASSISTANT REGISTRAR OF TITLES

Mortgage B77792 to The National Bank of Australasia Limited. Registered 29th January 1976 at 11.57 o'c.

OFFICE OF TITLES Western Australia

Discharge C988867 of Mortgage B077792 Registered 28th March, 1985 at 9.13 o'c.

OFFICE OF TITLES Western Australia

W.

Q 5/8/71

WESTERN AUSTRALIA.

George the Fifth, by the Grace of God of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, Defender of the Faith, To all to whom these Presents shall come, GREETING: Know Ye that We, of Our especial Grace, certain knowledge, and mere motion, have given and granted, and We do by these Presents, and successors, in consideration of the payment of the sum of £14-0-0 and the fulfilment of the prescribed conditions to the satisfaction of Our State of Western Australia, Give and Grant unto William Walter Hutton of Capel in Our said State, Far (hereinafter called the Grantee), the natural surface and so much of the land as is below the natural surface to a depth of 2 of ALL THAT Piece or Parcel of Land situate and being in the Town of Capel in Our said State, containing seven Capel S and ~~roods~~ thirty two perches, more or less and marked and distinguished in the Maps and Books of the Department of Lands and Surveys of Our said State as Lot 56 and as the same is delineated and coloured green in the plan drawn in the margin hereof; TOGETHER with all Profits, Commoditie and Appurtenances whatsoever thereunto belonging, or in anywise appertaining: TO HAVE AND TO HOLD the said Piece or Parcel of Land to the depth aforesaid, and all and singu hereby granted, with their appurtenances, unto the said Grantee, his heirs, and assigns for ever; he and they Yielding and Paying for the same to Us, Our heirs and successors, yearly rent on the twenty-fifth day of March in each year, or so soon thereafter as the same shall be lawfully demanded: PROVIDED, NEVERTHELESS, that it shall (at any time within from the date of these Presents) be lawful for Us, Our heirs and successors, or for any person or persons acting in that behalf by Our or their authority, to resume and enter upon posse of the said Piece or Parcel of Land, which it may at any time by Us, Our heirs and successors, be deemed necessary to resume for roads, tramways, railways, and railway stations, canals, paths, harbour or river improvement works, drainage or irrigation works, quarries, and generally for any other works or purposes of public use, utility or convenience, and for the purpose power to search for minerals hereinafter reserved, and such Lands so resumed to hold to Us, Our heirs and successors, as of Our or their former estate without making to the said Grantee, assigns, any compensation in respect thereof; so, nevertheless, that no such resumption be made without compensation of any part of the said Piece or Parcel of Land upon which any expenditure shall have been made by the said Grantee, his heirs, and assigns; and we do hereby save and reserve to Us, Our heirs and successors, all Mines of Gold, Silver, Copper, Tin, or other Mineral, or other substances containing metals, and all Gems or Precious Stones and Coal or Mineral Oil and all phosphatic substances in or under the said Piece or Parcel of Land hereby granted at all times to search and dig for and carry away the same; and for that purpose to enter upon the said Piece or Parcel of land or any part thereof.

Lot 56

IN WITNESS whereof We have caused Our trusty and well-beloved SIR FRANCIS ALEXANDER NEWDIGATE-NEWDEGATE, Knight Commander Distinguished Order of Saint Michael and Saint George, Governor in and over the State of Western Australia and its Depe Commonwealth of Australia, to affix to these Presents the Public Seal of the said State.

Sealed this Fourth *day of* February, *One thousand nine hundred and twenty-four*

F. A. Newdegate

S. 284c.

Grant under "The Land Act, 1898."

A. Thomas

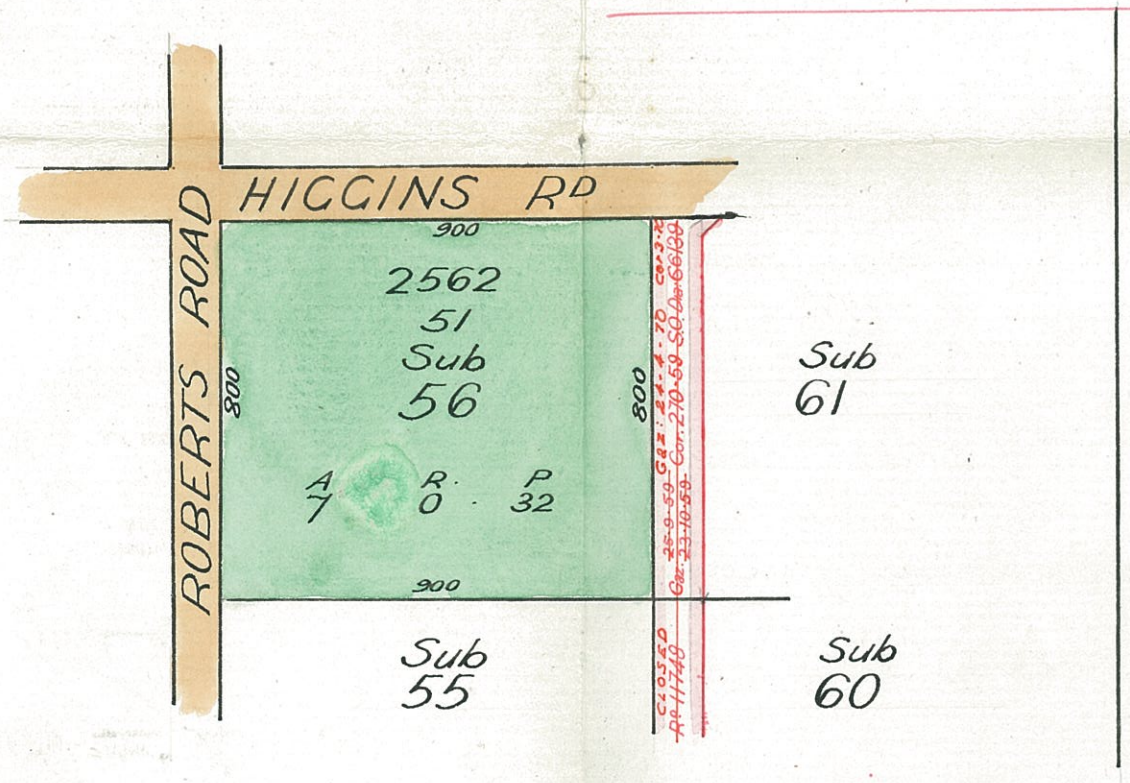
Acting Minister for Lands.

The area and measurements on the Plan below are more or less, and a peg has been placed at each corner of the Lot.

TRANSFER 5983/1952 to Stanley Roy Hutton of Capel, Farmer.
Registered this 8th day of April 1952
at 9 o'c.
W.
Registrar of Titles

Transfer A171437 to Westralian Sands Limited. of 44 Parliament Place,
Registered 29th May 1969at 9.23 o'c.

PLAN HEREIN REFERRED TO:



Scale:- 1 chain to an inch

Surveyed by C.M.Denny
O.P. Capel 32 2 Corr 12367 04
Ed

J. Thomas

SURVEYOR GENERAL

APPLICATION H637003

VOLUME	FOLIO
481	152A
1179	251

WESTERN AUSTRALIA

VOLUME	FOLIO
2204	99

IN THE REGISTER

CERTIFICATE OF TITLE

UNDER THE " TRANSFER OF LAND ACT, 1893 " AS AMENDED

The person described in the First Schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the Second Schedule.

DATED 4TH JANUARY, 2001

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

CAPEL SUBURBAN LOT 55 AND PORTION OF CAPEL SUBURBAN LOT 60 TOGETHER BEING LOT 2 THE SUBJECT OF DIAGRAM 90768, DELINEATED ON THE MAP IN THE THIRD SCHEDULE HERETO.

REGISTERED PROPRIETOR:

FIRST SCHEDULE (continued overleaf)

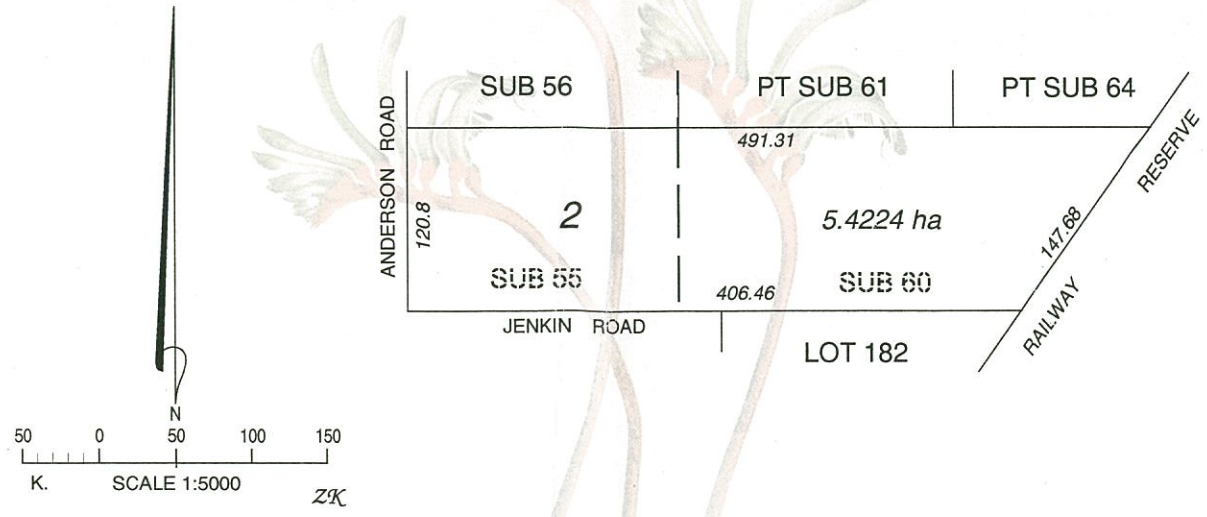
ILUKA RESOURCES LTD OF JENKIN ROAD, CAPEL.

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:

SECOND SCHEDULE (continued overleaf)

NIL

THIRD SCHEDULE



APPLICATION H637004

VOLUME 481 FOLIO 152A

WESTERN AUSTRALIA

VOLUME **FOLIO**
2204 **100**
IN THE REGISTER

CERTIFICATE OF TITLE

UNDER THE " TRANSFER OF LAND ACT, 1893 " AS AMENDED

The person described in the First Schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the Second Schedule.

DATED 4TH JANUARY, 2000

REGISTRAR OF TITLES

LAND DESCRIPTION:

PORTION OF EACH OF CAPEL SUBURBAN LOTS 61 AND 64 ON CROWN PLAN CAPEL 32/2, DELINEATED ON THE MAP IN THE THIRD SCHEDULE HERETO.

REGISTERED PROPRIETOR:

FIRST SCHEDULE (continued overleaf)

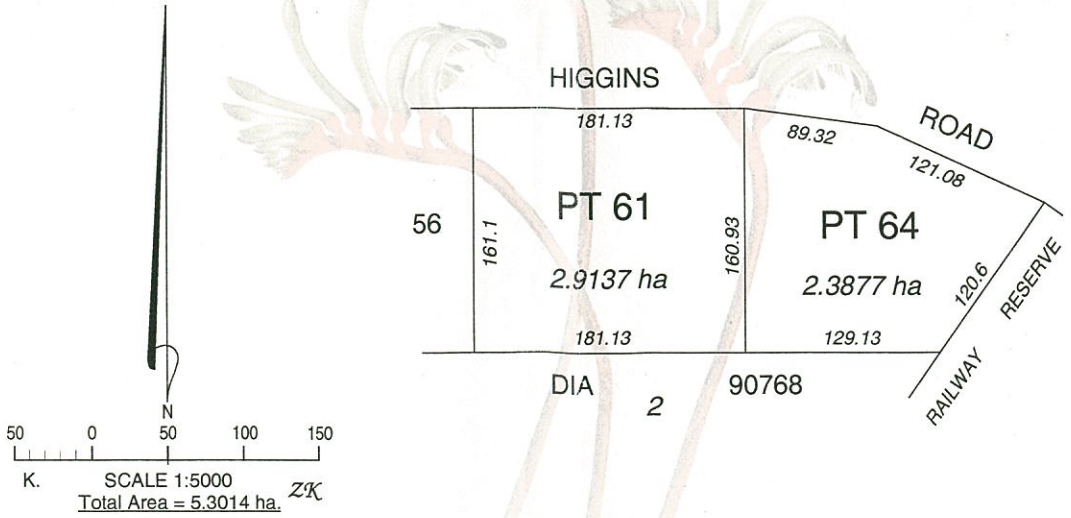
ILUKA RESOURCES LTD OF JENKIN ROAD, CAPEL.

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:

SECOND SCHEDULE (continued overleaf)

NIL

THIRD SCHEDULE



VOLUME FOLIO
2204 100
IN THE REGISTER

FIRST SCHEDULE (continued)

NOTE : ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS

PARTICULARS	INSTRUMENT NATURE	INSTRUMENT NUMBER	REGISTERED	TIME	SEAL & INITIAL

SECOND SCHEDULE (continued)

	REGISTERED or LODGED	TIME	SEAL & INITIAL	CANCELLATION NATURE	CANCELLATION NUMBER	REGISTERED or LODGED	SEAL & INITIAL