Terratree

Targeted Flora and Vegetation Survey of Yandin Road Area

Subject to CPS 7925/2 Conditions

Prepared for DECMIL

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ecological assessment
& management

Document Control

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Abbreviations and Acronyms

BoM	Bureau of Meteorology
DAFWA	former Department of Agriculture and Food Western Australia (now DPIRD), WA Government
DBCA	Department of Biodiversity, Conservation and Attractions, WA Government
DEE	Department of the Environment and Energy, Australian Government
DPIRD	Department of Primary Industries and Regional Development, WA Government
EPA	Environmental Protection Authority, WA Government
GDA94	Geocentric Datum Australia 1994
IBRA	Interim Biogeographic Regionalisation for Australia

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Executive Summary

Decmil commissioned Terratree to undertake a Targeted flora and vegetation and Black Cockatoo habitat tree survey of an area along Yandin road in the Shire of Dandaragan. The purpose of the survey which was to inform obligations in relation to conditions stipulated in Purpose Permit CPS 7925/2 with regards to impacts on Threatened and/or Priority flora and Black Cockatoo habitat trees.

The Study area is located on the Yandin road and it is southeast of the Shire of Dandaragan.

The Yandin Road Clearing Permit area that is subject to conditions stipulated in Purpose Permit CPS 7925/2 (hereafter referred to as 'the survey area') is located approximately 170 km north of Perth. The survey area is located approximately 15 km east of the Brand Highway along Yandin Road, either side of the main entrance to the Yandin Wind Farm Site Office and is approximately 1.7 ha in size.

The Targeted Flora and Vegetation survey was conducted during the peak flowering period between 29th of October and 2nd of November 2019, by Principal Ecologist Joseph Grehan and Senior Ecologist Tamara Kabat of Terratree.

The flora and vegetation field assessment was conducted in accordance with the methods described in EPA *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA & DPaW, 2015). Specifically, the assessment included:

- a Desktop study; and
- a Targeted survey for Threatened and Priority flora

The survey area was traversed on foot along 5 m wide transects, 2.5 m either side of a centre line, searching for Threatened and Priority flora species identified in the desktop study. Specimens of possible Priority flora species were collected, and their location was recorded with a hand-held GPS unit (accuracy to 3m), along with the number of individuals present. Relevés were conducted to delineate vegetation communities as they were encountered.

No Threatened flora species were recorded during the survey, however two Priority flora species *Banksia dallanneyi* subsp. *?pollosta* (P3) and *Anigozanthos humilis* subsp. *chrysanthus* (P4) were recorded within the survey area.

Banksia dallanneyi subsp. *?pollosta* was recorded across the survey area in both Vegetation Communities 1 and 2. In total 21 plant locations were recorded within the CPS Area subject to conditions, Two individuals of *Anigozanthos humilis* subsp. *chrysanthus* were recorded within the CPS Area subject to conditions.

No trees were recorded within the survey area had suitable hollows for Black Cockatoo nesting. Three Marri trees, (*Corymbia calophylla*) located at the edge of the CPS area subject conditions, had evidence of recent foraging by Carnaby's Cockatoo (Endangered). *Calyptorhynchus latirostris*, who were also observed foraging within the survey area along Yandin Road. There was also evidence of foraging on *Banksia attenuata* fruit outside the CPS area subject conditions.

Two vegetation communities were recorded during the survey. While vegetation Community Type 1 didn't have any Banksia tree species present, Community Type 2 has both *Banksia attenuata and B menziesii* present The composition of Community Type 2 is consistent with the description of the Banksia Woodland Threatened Ecological Community as detailed in the *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (s 266B) (DoEE 2016.):

Annual weed species present included *Bromus sp*. (Broom grass), *Brizia maxima* (Blowfly grass), *Ehrharta longifolia* (Annual Veldt grass). Perennial weed species present included *Pelargonium capitatum (Rose pelargonium), Gladiolus caryophyllaceus* (Pink gladiolus). None of these weed species are Declared Weeds under the *BAM Act* 2007, or Weeds of National Significance.

Terratree makes the following recommendations for future development on site:

- The proponent should consider whether a referral to the Department of Environment and Energy is required before disturbing Community Type 2 as it meets the description of the Banksia Woodland of the Swan Coastal Plain Ecological Community which is a federally listed Threatened Ecological Community under the *EPBC Act 1999*.
- Ensure machinery entering site, especially earth-moving equipment is 'clean on entry' to the survey area i.e. free of soil and vegetative materials to prevent the introduction of weeds and pathogens;
- If significant populations of Priority flora are to be impacted, then every effort should be made to minimise impacts by demarcating populations prior to ground disturbance activities;
- Impacts to Black Cockatoo habitat should be focused on avoidance and mitigation, as per Table 2 in the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (SEWPAC 2012). Specific recommendations for the survey area include:
    - Trees that provide significant habitat for Black Cockatoos should be retained if possible during construction; and
    - Avoidance and control of the introduction of pathogens and plant diseases during activities which may negatively impact retained or surrounding habitat of the development.

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1 Introduction

1.1 Background

Decmil commissioned Terratree Pty Ltd (Terratree) to undertake a Targeted flora and vegetation and Black Cockatoo habitat tree survey of an area along Yandin road in the Shire of Dandaragan. The purpose of the survey which was to inform obligations in relation to conditions stipulated in Purpose Permit CPS 7925/2 with regards to impacts on Threatened and/or Priority flora and Black Cockatoo habitat trees.

1.2 Project Location and Size

The Study area is located on the Yandin road and it is southeast of the Shire of Dandaragan.

The Yandin Road Clearing Permit area that is subject to conditions stipulated in Purpose Permit CPS 7925/2 (hereafter referred to as 'the survey area') is located approximately 170 km north of Perth (**Figure 1**). The survey area is located approximately 15 km east of the Brand Highway along Yandin Road, either side of the main entrance to the Yandin Wind Farm Site Office and is approximately 1.7 ha in size.

1.3 Scope of work

The scope of work for the project included the following:

- Conduct an initial desktop assessment to determine the broad environmental values of the study area;
- Undertake a Targeted Flora and Vegetation survey;
- Describe the vegetation communities present
- Identify the presence of any Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), Threatened or Priority Flora species and provide a map showing locations of these;
- Recommend best practice management techniques to avoid impacts to significant conservation values and, if unavoidable, to minimise and mitigate impacts associated with construction activities; and
- Prepare a comprehensive report detailing the results of the survey.

2 Regulatory Context

The following is a list of relevant government legislation, government policy, publications and project reports pertaining to the site:

2.1 Legislation

- *Biodiversity Conservation Act* (BC Act) 2016 (Western Australia)
- *Environmental Protection Act* (EP Act) 1986 (Western Australia)
- *Western Australian Planning and Development Act 2005* (Western Australia)
- *Biosecurity and Agriculture Management Act* (BAM Act) 2007 (Western Australia)
- *Environmental Protection and Biodiversity Conservation Act* (EPBC Act) 1999 (Federal)

2.2 Government Policy and Publications

- Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia (EPA 2000)
- Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002)
- Environmental Protection (Clearing of Native Vegetation) Regulation 2004
- Environmental Protection (Environmentally Sensitive Areas) Notice 2005
- EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (Department of Sustainability, Environment, Water, Population and Communities [SEWPAC] 2012).
- EPA Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)

2.3 Threatened and priority flora

2.3.1 Biodiversity Conservation Act (2016) (Western Australia)

Taxa which have been adequately searched for and are deemed to be either rare, in danger of extinction or otherwise in need of special protection in the wild, are gazetted as Threatened Species (Schedule 1, BC Act 2016). Threatened Species are further categorised by the Department according to their level of threat using IUCN Red List criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild;
- EN: Endangered – considered to be facing a very high risk of extinction in the wild in the near future; and
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild in the medium-term future.

These taxa are legally protected and their removal or impact to their surroundings cannot be conducted without Ministerial approval, obtained specifically on each occasion for each population (Table C.2., Error! R eference source not found.)

2.3.2 Priority Flora

The Department of Biodiversity, Conservation and Attractions (DBCA, formerly DPaW) maintains a list of Priority Flora taxa, which are considered poorly known, uncommon or under threat but for which there is insufficient justification, based on known distribution and population sizes, for inclusion in Schedule 1 of the BC Act. The list of Threatened (Declared Rare) flora is reviewed annually by a scientific panel that assess a taxon's conservation status and ranks them into categories. The Priority Flora list is dynamic. As new information becomes available conservation status is reviewed and changes to the listing may result. The

categories for Priority Flora give an indication of the priority for undertaking further surveys based on the number of known sites, and degree of threat to those populations. A Priority taxon is assigned to one of five priority categories (**Appendix B**)

2.3.3 Locally and Regionally Significant Flora and Vegetation

In addition to plant taxa being recognised as significant through their Declared Rare of Priority Flora status, they can also be significant for a number of other reasons. The EPA Technical Guide for Flora and Vegetation Surveys (EPA 2016) states that flora and vegetation can be "significant" for a range of reasons including but not limited to:

Flora

- "Being identified as threatened or priority species
- Locally endemic or association with a restricted habitat type (e.g. surface or groundwater dependent ecosystems)
- New species or anomalous features that indicate a potential new species
- Representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions or isolated outliers of the main range)
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape".

Vegetation

- "Being identified as threatened or priority ecological communities
- Restricted distribution
- Degree of historical impact from threatening processes
- A role as a refuge
- Providing an important function required to maintain ecological integrity of a significant ecosystem".

2.4 Threatened and Priority Fauna

In a legislative context, the conservation of fauna is covered primarily by the following legislation and international treaties:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Biodiversity Conservation Act 2016*
- *Environmental Protection Act 1986*

The following documents are relevant to the management of fauna:

- EPA Position Statement Nº. 3: Terrestrial Biological Surveys
- EPA Guidance Statement Nº. 51: Terrestrial Flora and Vegetation Surveys
- EPA Guidance Statement Nº. 56: Terrestrial Fauna Surveys
- EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (Department of Sustainability, Environment, Water, Population and Communities 2012).

Any animal that is native to WA is protected under the State's primary wildlife conservation legislation, the Biodiversity Conservation Act (2016). Some fauna species have additional protection at a Federal level under the *EPBC Act.* Penalties apply for any damage to individuals, populations or habitats of protected species.

2.4.1 Environment Protection and Biodiversity Conservation Act (1999) (Commonwealth of Australia)

At a Commonwealth level, Threatened fauna are protected under the EPBC Act, which lists species that are considered Critically Endangered, Endangered, Conservation Dependant, Extinct or Extinct in the Wild (Table C.1., Error! Reference source not found.).

2.4.2 *Biodiversity Conservation Act* (2016) (Western Australia)

Fauna species which have been adequately surveyed and are deemed to be either rare, in danger of extinction or otherwise in need of special protection are gazetted as Threatened Species (Schedule 1, BC Act 2016). These taxa are legally protected and their removal or impact to their surroundings cannot be conducted without Ministerial approval, obtained specifically on each occasion for each population (Table C.3., Error! Reference s ource not found.)

2.5 Threatened and Priority Ecological Communities

Ecological communities are naturally occurring biological assemblages located in a particular type of habitat. At a national level, Threatened Ecological Communities (TECs) are protected under the EPBC Act. TECs are listed under the EPBC Act as either 'Critically Endangered', 'Endangered' or 'Vulnerable'

The DBCA also maintains a list of TECs endorsed by the Minister of Environment (DEC, 2015) that are classified as being either 'Presumed Totally Destroyed', 'Critically Endangered', 'Endangered' or 'Vulnerable'.

The DBCA maintains an additional list of Priority Ecological Communities (PECs), for communities that could potentially be classified as TECs, but are not currently adequately defined or surveyed. Communities are placed into one of five Priority categories (1-5).

Definitions of these conservation codes are provided in(Appendix B)

2.6 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister can, by notice, declare an area of the State specified in the notice or an area of the State to be an Environmentally Sensitive Area (ESA). ESAs are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004* and are selected for their environmental values at state or national levels. ESA's can be assigned with regard to the following criteria:

- Protection of rare or threatened species of native plants;
- Protection of wetlands and water courses;
- Protection of sites that have other high conservation, scientific or aesthetic values;
- Protection of Aboriginal or European cultural sites; or
- A declared World Heritage property as defined in section 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Ac*t) of the Commonwealth.

An ESA is defined under Regulation 6(1) of the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004* as including:

- An area that is registered on the Register of the National Estate, because of its natural values, under the Australian Heritage Commission Act 1975 of the Commonwealth;
- A defined wetland and the area within 50 m of the wetland;
- The area covered by vegetation within 50 m of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located;
- The area covered by a threatened ecological community; and
- A Bush Forever site listed in "Bush Forever" Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site may be cleared under a decision of the Western Australia Planning Commission.

2.7 Introduced Flora

2.7.1 Weeds of National Significance (WONS)

At a national level there are twenty weed species listed as Weeds of National Significance (WONS). *The Commonwealth National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance* (2012) describes the broad goals and objectives in managing these species.

2.7.2 Declared Plants

The *Biosecurity and Agriculture Management Act* 2007 (BAM Act, DAFWA, 2007) seeks to prevent serious animal and plant pests and diseases from entering the State and becoming established, and to minimise the spread and impact of any that are already present. The BAM Act, and associated regulations, replace the *Agriculture and Related Resources Protection Act* 1976 (and associated regulations). The BAM regulations were enacted on 1 May 2013, placing organisms into four categories:

- Permitted organism (listed under Section 11) – permitted in Western Australia subject to regulations;
- Prohibited organism (listed under Section 12) – prohibited in Western Australia subject to regulations (i.e. is a Declared Pest for the whole of the State);
- Permitted organism: permit required (under regulation 73) – must not be imported unless in accordance with an import permit; and
- Permitted organism: Declared Pests (under Section 22) – can apply to a part of, or the whole of, the State.

The current Western Australian Organism List (WAOL) (DAFWA, 2018) lists organisms in each of these categories. Unlisted organisms must not be imported (unless in accordance with an import permit and regulations). The BAM Act further categorises Declared Pests in one of three control categories (**Table 1**):

Table 1: Control categories for Declared Pests.

Declared Plant Category	Description
C1 - Exclusion	Pests assigned to this category are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 - Eradication	Pests assigned to this category are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 - Management	Pests assigned to this category are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

*Source: BAM Act 2007 and WAOL (DAFWA, 2018).

2.7.3 Environmental Weeds

A second and much more extensive categorisation of weeds has been developed by the DBCA in the Environmental Weed Strategy (Department of Conservation and Land Management, 1999). Species considered to adversely affect the communities they invade are evaluated on the following criteria:

- **Invasiveness:** ability to invade bushland in good to excellent condition, or ability to invade waterways (scored as yes or no);
- **Distribution:** wide current or potential distribution including consideration of known history of widespread distribution elsewhere in the world (scored as yes or no);

- **Environmental impacts:** ability to change the structure, composition and function of ecosystems; in particular, an ability to form a monoculture in a vegetation community (scored as yes or no).

Weeds listed as Environmental Weeds are ranked into four categories using the above criteria and scoring system:

- **High:** a species which scores yes to all three of the above criteria. A rating of high indicates a species that should be prioritised for control and/or research;
- **Moderate:** a species which scores yes for two of the above criteria. A rating of moderate indicates a species which should be monitored. Control or research should be directed to it if funds are available;
- **Mild:** a species which scores yes to one of the criteria. A mild rating indicates monitoring or control if appropriate; and
- **Low:** a species which does not score yes for any of the criteria. A low rating indicates a low requirement for monitoring.

3 Existing Environment

3.1 Biogeography

There are 89 recognised Interim Biogeographical Regionalisation Areas (IBRA) Regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna. The study area lies in the Swan Coastal Plain region, within the Drummond Botanical Subdistrict of the Southwestern Botanical Province as described by Beard (1990).

The climate experienced in this district is described as dry warm Mediterranean and typically experiences 5-6 dry months a year, with an annual rainfall of 600 – 1000mm. The Southwestern Botanical Province is typified by plants from the families Fabaceae (*Acacia* spp.), Proteaceae (*Grevillea* spp.), Myrtaceae (*Melaleuca* spp.), Papilionaceae (*Daviesia* spp.), Casuarinaceae (*Allocasuarina* spp.) and Poaceae (grasses) (Mattiske, 2000). The Drummond Botanical Subdistrict is characterised by mainly *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; woodland of tuart (*Eucalyptus gomphocephala*), jarrah (*E. marginata*) and marri (*Corymbia calophylla*) on less leached soils.

The dominant land uses include urban development, dry land agriculture, Unallocated Crown Land and Crown reserves, conservation, forestry plantations and road easements and infrastructure.

3.2 Soils and Landforms

The Swan Coastal Plain is made up of mostly depositional material either from fluviatile or aeolian activity. The plain has coastal dunes, of which the Bassendean Dune System is the most easterly, followed by the Spearwood System and the Quindalup System fringing the coastline (McArthur 2004). Most of the Drummond Botanical Subdistrict is underlain with Mesozoic to recent sediments of the Perth Basin (Beard, 1990). The Bassendean Dunes on which the project area is located consist of low, vegetated hills of quartz sand with numerous interdunal swamps and lakes (Beard, 1990). The sands are bleached white at the surface, however, are yellow at depth (Beard, 1990). The Bassendean system soils vary based on drainage and depth to groundwater. Well drained sites on crests and upper slopes have depth to groundwater of over 10m, however areas where relief is very low the water table rises to within 2m of the surface (McArthur 2004).

3.3 Regional Vegetation

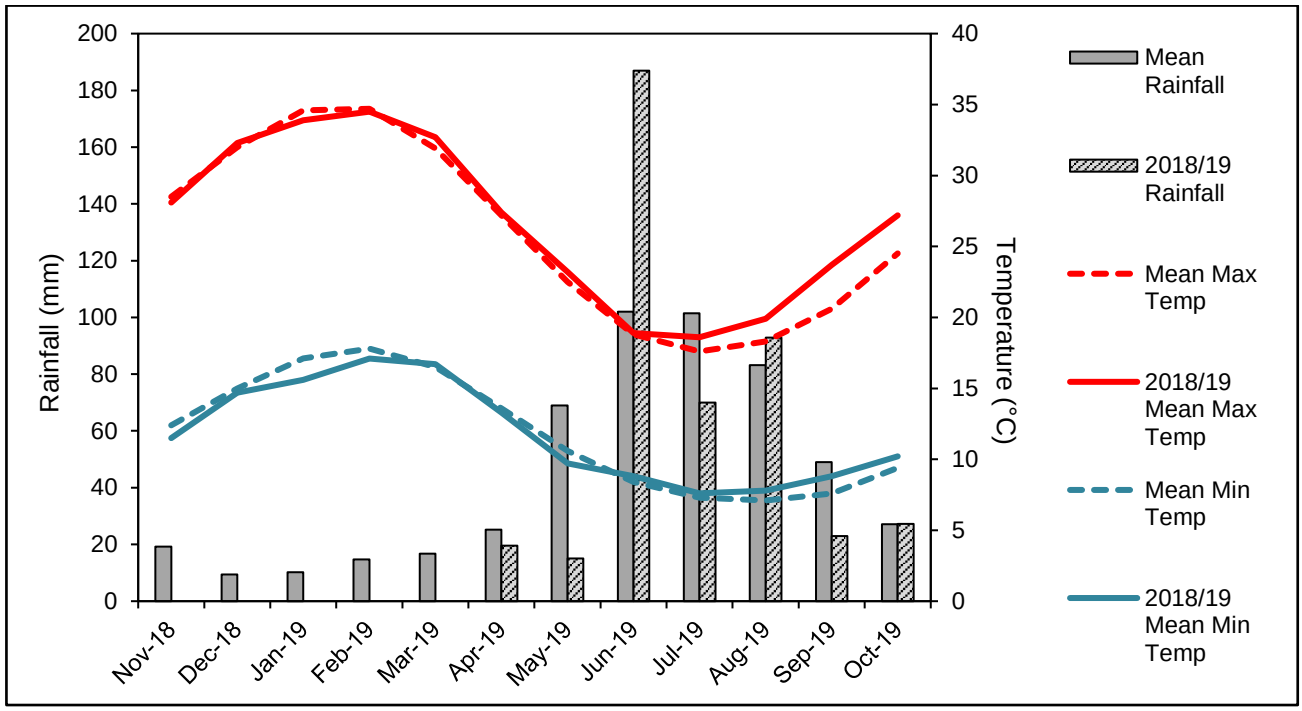
The study area is located in the northern portion of the Swan Coastal Plain (Drummond Botanical Sub-district) of the Southwestern Province (Beard, 1990). This region supports a mainly banksia low woodland, however dune swales tend always to be swampy, with mainly heath communities of tea tree, paperbark and reed swamps in these conditions (Beard, 1990). The region supports trees of mainly 6-8m tall, with the main species being *Banksia attenuata, B. menziesii* and on wetter sites *B. ilicifolia,* along with *Eucalyptus todtiana* and *Nuytsia floribunda* (Beard, 1990).

The survey area is described as having an overstorey of *Banksia attenuata, B. menziesii* and *Eucalyptus todtiana* over a shrub layer of *Adenanthos cygnorum, Allocasuarina humilis, Jacksonia furcellata, Xanthorrhoea preissii, Anigozanthos humilis, Conostylis aculeata* and *Eremaea fimbriata* (Beard, 1990).

3.4 Climate

The Yandin Survey Area is in Dandaragan Plateau, Dandaragan Shire, located in the Wheatbelt region of Western Australia. The statistical data of the rainfall from this area indicates that on average, the rainfall was considerably lower from November 2018 to November 2019 compared to previous years apart from June 2019. The statistical data on temperature from the Bureau of Meteorology (BoM) website indicates that Dandaragan

had a maximum mean temperature ranging from 32 to 36 degrees Celsius and a minimum mean temperature of 6 to 18 degrees Celsius from June to September.



Graph 1. Rainfall and temperature data for Badgingarra Research Station #9573 (BoM 2019b).

4 Methods

The Targeted Flora and Vegetation survey was conducted during the peak flowering period between 29th of October and 2nd of November 2019, by Principal Ecologist Joseph Grehan and Senior Ecologist Tamara Kabat of Terratree.

The flora and vegetation field assessment was conducted in accordance with the methods described in EPA *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA & DPaW, 2015). Specifically, the assessment included:

- a Desktop study; and
- a Targeted survey for Threatened and Priority flora

The survey area was traversed on foot along 5 m wide transects, 2.5 m either side of a centre line, searching for Threatened and Priority flora species identified in the desktop study. Specimens of possible Priority flora species were collected, and their location was recorded with a hand-held GPS unit (accuracy to 3m), along with the number of individuals present. Relevés were conducted to delineate vegetation communities as they were encountered.

Where species could not be identified in the field, they were collected, labelled, pressed, dried and frozen in accordance with the requirements of the West Australian Herbarium. Subsequent to freezing the collected plant specimens were later identified by experienced Joseph Grehan using his personal knowledge, comparison with pressed specimens housed at the herbarium, taxonomic keys and other reference materials.

4.1 Threatened and Priority Flora

Prior to the survey descriptions and photographs of Threatened and Priority Flora identified in database searches or previously recorded in the area, were compiled from FloraBase and available literature to produce a 'field guide' to assist botanists with identification of target species during the survey.

Priority flora that were identified in the field were given a GPS location with the species name and the amount of plants within 3m of the GPS location. A specimen was taken for confirmation by an experienced taxonomist at the WA herbarium.

Individual plants or groups of plants were recorded using handheld GPS units. Where groups of plants were recorded, the location of the approximate centre of the group and number of individuals were recorded.

Specimens were recollected to confirm identification whenever a Priority species was encountered.

The locations of Priority flora were mapped in QGIS 3.2 software (QGIS Development Team, 2018 **.**

4.2 Traverse

The survey area was traversed on foot along 5m wide transects, 2.5 m either side of a centre line, searching for Threatened and Priority flora species identified in the desktop study. Specimens of possible Priority flora species were collected, and their location was recorded with a hand-held GPS unit (accuracy to 3m), along with the number of individuals present.

Vegetation communities were described based on the nomenclature of the National Vegetation Information System (NVIS) (ESCAVI, 2003). Vegetation mapping was conducted by delineating plant communities based on distinctive characteristics such as vegetation structure, dominant species and species composition. A combination of aerial photography and ground-truthing was used to interpret the vegetation patterns present in the study area. Weed species present were recorded and photographed.

4.3 Vegetation Condition

The level of classification of vegetation condition was determined based on the (perceived) ability of the bushland to maintain itself (**Table 3**). Disturbance and degree of alteration to the community in terms of structure and ecological function were also considered).

Table 2: Keighery Vegetation Condition Scale (Keighery, 1994)

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

4.4 Significant Fauna Habitat

An assessment of the fauna habitat values was conducted during the survey. In particular, the fauna assessment focussed on potential habitat for the Threatened species of Black Cockatoos: Carnaby's Cockatoo (Endangered). *Calyptorhynchus latirostris.* Potential breeding habitat trees as per the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (SEWPAC 2012) are described as:

> *"'…trees of species known to support breeding…" "…within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm."*

Potential foraging tree species include that could be present include Marri (*Corymbia calophylla*) and Banksia tree; *Banksia attenuata* and *B. menziesii.*

4.5 Mapping

4.5.1 Vegetation Communities

Vegetation community areas were digitised using QGIS 3.2 software (QGIS Development Team, 2018), by digitising vector polygons over a high-resolution aerial photograph layer.

5 Results

5.1 Threatened and Priority Flora

No Threatened flora species were recorded during the survey, however two Priority flora species *Banksia dallanneyi* subsp. *?pollosta* (P3) and *Anigozanthos humilis* subsp. *chrysanthus* (P4) were recorded within the survey area.

5.1.1 Banksia dallanneyi subsp. ?*pollosta* (P3)

Banksia dallanneyi subsp. *?pollosta* was recorded across the survey area in both Vegetation Communities 1 and 2. In total 21 plant locations were recorded within the CPS Area subject to conditions. (The spatial location of this species can be found in **Figure 2,** and a picture in **Plate 1** .

5.1.2 Anigozanthos humilis subsp. *chrysanthus* (P4)

Two individuals of *Anigozanthos humilis* subsp. *chrysanthus* were recorded within the CPS Area subject to conditions. The location of this specimen can be found in **Figure 2**, and a picture in **Plate 2**.

5.2 Introduced Flora (Weeds)

Annual weed species present included *Bromus sp*. (Broom grass), *Brizia maxima* (Blowfly grass), *Ehrharta longifolia* (Annual Veldt grass). Perennial weed species present included *Pelargonium capitatum (Rose pelargonium), Gladiolus caryophyllaceus* (Pink gladiolus). None of these weed species are Declared Weeds under the *BAM Act* 2007, or Weeds of National Significance.

5.3 Vegetation Communities

In total, two plant communities were identified during the survey. Vegetation communities are detailed below (**Appendix A**).

Table 3: Vegetation community descriptions from the Yandin Road survey area.

Type	Vegetation Community Description
Type 1	Closed shrubland of *Allocasuarina humilis, Eremaea pauciflora*, *Banksia hewardiana, Hakea ruscifolia, Petrophile brevifolia*, over *Xanthorrhoea preissii*, *Babingtonia grandiflora* and *Banksia dallanneyi* subsp. *pollosta* over **Ehrharta calycina*
Type 2	Tall Open forest of *Corymbia calophylla* over open woodland of *Banksia attenuata and B menziesii, over closed shrubland of Adenanthos cygnorum, Allocasuarina humilis, Xanthorrhoea preissii, Macrozamia riedleii, Hibbertia hypericoides, H. subvaginata, Stirlingia latifolia, Ehrharta calycina* and Pelargonium capitatum**

5.4 Vegetation Condition

Vegetation condition in the Community Type 1 was rated as Excellent, with Community type 2 rated as Very Good, in accordance with the Keighery Condition Scale (Keighery, 1994). Impacts to vegetation were as a result of dust exposure along the unsealed public road and weeds.

5.5 Significant Fauna Habitat

No trees were recorded within the survey area had suitable hollows for Black Cockatoo nesting. Three Marri trees (*Corymbia calophylla*), located at the edge of the CPS area subject conditions, had evidence of recent

foraging by Carnaby's Cockatoo (Endangered). *Calyptorhynchus latirostris*, who were also observed foraging within the survey area along Yandin Road (**Plates 3,4 &5**). There was also evidence of foraging on *Banksia attenuata* fruit outside the CPS area subject conditions (**Plate 6**).

5.6 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESA's) can be applicable to a range of environmental, heritage and vegetation values. ESA's that are potentially applicable within the study area include:

- a Defined Wetland and the area within 50 metres of the wetland;
- the area covered by vegetation within 50 metres of Declared Rare Flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located; and
- the area covered by a threatened ecological community (TEC).

A search of the interactive WA Atlas on Landgate's Shared Land Information Platform (SLIP) website confirmed that there are no Defined Wetlands within the study area.

The project area lies within the area of the Endangered Banksia Woodlands TEC. Community type 2 meets the description of the TEC and would therefore classify as an ESA.

6 Discussion

6.1 Threatened and Priority Flora

Priority Flora recorded within the study area are described in detail below.

***Banksia dallanneyi* subsp. *pollosta* (P3)**

Banksia dallanneyi subsp. *pollosta* is a prostrate, lignotuberous shrub that flowers yellow -brown from August to September, and commonly occurs in grey or yellow sand on predominantly flat topography.

Banksia dallanneyi subsp. *pollosta* differs from *Banksia dallanneyi* subsp. *dallanneyi* in that its leaves are narrower and there are more lobes per leaf, fewer flowers per head and an upright habit. The taxonomic differences between the two species is discussed in **Table 4** below.

Table 4: Taxonomic descriptions of *Banksia dallanneyi* subsp. *pollosta* and *Banksia dallanneyi* subsp. *dallanneyi* Cavanagh and Pieroni (2006).

Description	*Banksia dallanneyi* subsp. *pollosta*	*Banksia dallanneyi* subsp. *dallanneyi*
Habit	More upright habit	Less upright habit
Leaf width	2-3 mm	3-8 mm
Lobes per leaf	60-80	30-60
Flower per head	35-45	50-70

The collected specimens were definitively identified due to the leaves having on average 66 lobes, and the leaf width average approximately less than 3mm. *Banksia dallanneyi* subsp. *pollosta* is said to grade into *Banksia dallanneyi* subsp. *dallanneyi* to the south of its range (Cavanagh and Pieroni 2006). There is the potential for the specimens found during this survey to be transitional.

It was decided that the specimens are likely to be *Banksia dallanneyi* subsp. *pollosta* due to their habit, leaf width and the presence of leaves with up to 66 lobes per leaf. A precautionary approach was decided to be taken, due to *Banksia dallanneyi* subsp. ?*pollosta* being classified as a Priority 3 species, however there is potential for some specimens to be *Banksia dallanneyi* subsp. *dallanneyi*. In total 21 plants recorded could potentially be impacted by clearing for the access road.

***Anigozanthos humilis* subsp. *chrysanthus* (P4)**

Anigozanthos humilis subsp. *chrysanthus* is a rhizomatous, perennial herb that reaches 0.8m in height, with yellow flowers, flowering from July to October (Florabase 2018). The species grows together with *Anigozanthos humilis* subsp. *humilis,* in sandy loam soil in open vegetation communities as well as in dense heath (Hopper 1993).

The species was able to be determined to be *Anigozanthos humilis* subsp. *chrysanthus* due to the completely yellow inflorescences and hairs being present on the leaf margins (Plate 3). *Anigozanthos humilis* subsp. *humilis* has yellow-red inflorescences, and no hairs present on the leaf margins of the plant.

6.2 Introduced Flora (Weeds)

Annual weed species present included *Bromus sp*. (Broom grass), *Brizia maxima* (Blowfly grass), *Ehrharta longifolia* (Annual Veldt grass). Perennial weed species present included *Pelargonium capitatum (Rose pelargonium), Gladiolus caryophyllaceus* (Pink gladiolus). None of these weed species are Declared Weeds under the BAM Act 2007, or Weeds of National Significance.

6.3 Vegetation Communities

Two vegetation communities were recorded during the survey. While vegetation Community Type 1 didn't have any Banksia tree species present, Community Type 2 has both *Banksia attenuata and B menziesii* present The composition of Community Type 2 is consistent with the following description of the Banksia Woodland Threatened Ecological Community as detailed in the *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (s 266B) (DoEE 2016.):

> Emergent taller trees that can occur above the *Banksia* canopy may include *Corymbia calophylla* (marri), *Eucalyptus gomphocephala* (tuart) and *E. marginata* (jarrah).
>
> Key species in the sclerophyllous shrub layer of the ecological community include members of the families Asteraceae, Dilleniaceae, Ericaceae, Fabaceae, Myrtaceae and Proteaceae. Widespread species include *Adenanthos cygnorum* (woolly bush), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Conostephium pendulum* (pearl flower), *Daviesia* spp., *Eremaea pauciflora*, *Gompholobium tomentosum* (hairy yellow pea), *Hibbertia hypericoides* (yellow buttercups), *Jacksonia* spp., *Kunzea glabrescens*, *Petrophile linearis* (pixie mops), *Philotheca spicata* (pepper and salt), *Stirlingia latifolia* (blueboy), *Phlebocarya ciliata*, *Hypolaena exsulca* and *Xanthorrhoea preissii* (balga).

6.4 Threatened, Schedule and Priority Fauna Habitat

No trees were recorded within the survey area had suitable hollows for Black Cockatoo nesting.

A total of three Marri (*Corymbia calophylla*) were recorded within the survey area which had evidence of recent foraging by Carnaby's Cockatoo (Endangered). *Calyptorhynchus latirostris*, who were also observed foraging within the survey area along Yandin Road All the trees have a Diameter at Breast Height (DBH) greater than 50 cm, and they are therefore considered to be potential Black Cockatoo habitat trees.

6.5 Limitations

The potential limitations of the survey, as outlined in the EPA Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) are outlined in a table below.

Table 5: Potential limitations and discussion of their relevance to the study area.

Potential Limitation	Discussion
Sources of information and availability of contextual information (i.e. pre-existing background vs. new material)	**Not a Limitation.** There was adequate local and regional background information to inform the Desktop study of the survey area.
Scope (e.g. what life forms, etc., were sampled)	**Not a limitation.** There were no limitations on the scope. The survey assessed vegetation types and vascular plant species within the study area, including Priority species.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Not a limitation**. The study was undertaken in accordance with the description of Targeted Surveys in EPA Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). Relevés were undertaken in accordance with the guide,

Potential Limitation	Discussion
	and plant specimens collected when botanists were not able to identify plants in the field. Opportunistic sampling was undertaken between relevés to ensure the survey area was adequately sampled.
Completeness and further work which may be needed (e.g. was the relevant area fully surveyed)	**Not a limitation**. The survey area was adequately surveyed, with botanists covering the entire survey area.
Taxonomic certainty	**A limitation.** While it was decided that the specimens are likely to be *Banksia dallanneyi* subsp. ?*pollosta* due to their habit, leaf width and the presence of leaves with up to 66 lobes per leaf. A precautionary approach was decided to be taken, due to the species being classified as a Priority 3 species, however there is potential for some specimens to be *Banksia dallanneyi* subsp. *dallanneyi*
Mapping reliability	**Not a limitation.** The vegetation mapping was based on the requirements outlined in the EPA Technical Guide for a detailed Flora and Vegetation. For planning and mapping purposes, detailed aerial imagery was provided by the Client.
Timing, weather, season, cycle	**Not a limitation.** The targeted survey was completed during the peak flowering period, on the 9th of the September 2019. Annual species were observable at the time of the survey.
Disturbances (fire, flood, accidental human intervention etc.)	**Not a Limitation.** The survey area was next to the unsealed road, this did not impede the survey.
Intensity (in retrospect, was the intensity adequate)	**Not a limitation.** The intensity of the survey was adequate. By the end of the survey no new vegetation types and few new plant species were being encountered.
Resources	**Not a limitation.** The field survey, plant identification and reporting were all adequately resourced.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a limitation.** The field survey was carried out by suitably qualified and experienced personnel Joseph Grehan with extensive experience for more than 15 years' in flora surveying and identification.

8 Conclusions and Recommendations

No Threatened flora species were recorded during the survey, however two Priority flora species *Banksia dallanneyi* subsp. *?pollosta* (P3) and *Anigozanthos humilis* subsp. *chrysanthus* (P4) were recorded within the survey area. In total there are 21 individuals of *Banksia dallanneyi* subsp. *?pollosta* (P3) and XX individuals of *Anigozanthos humilis* subsp. *chrysanthus* (P4) present within the within the CPS area subject to conditions.

No trees were recorded within the survey area had suitable hollows for Black Cockatoo nesting.

A total of three Marri (*Corymbia calophylla*) were recorded within the survey area which had evidence of recent foraging by Carnaby's Cockatoos, who were also observed foraging within the survey area along Yandin Road .All the trees have a Diameter at Breast Height (DBH) greater than 50 cm, and they are therefore considered to be potential Black Cockatoo habitat trees.

Two vegetation communities were recorded during the survey. While vegetation Community Type 1 didn't have any Banksia tree species present, Community Type 2 has both *Banksia attenuata and B menziesii* present The composition of Community Type 2 is consistent with the description of the Banksia Woodland Threatened Ecological Community as detailed in the *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (s 266B) (DoEE 2016.).

Terratree makes the following recommendations for future development on site:

- The proponent should consider whether a referral to the Department of Environment and Energy is required before disturbing Community Type 2 as it meets the description of the Banksia Woodland of the Swan Coastal Plain Ecological Community which is a federally listed Threatened Ecological Community under the *EPBC Act 1999*.
- Ensure machinery entering site, especially earth-moving equipment is 'clean on entry' to the survey area i.e. free of soil and vegetative materials to prevent the introduction of weeds and pathogens;
- If significant populations of Priority flora are to be impacted, then every effort should be made to minimise impacts by demarcating populations prior to ground disturbance activities;
- Impacts to Black Cockatoo habitat should be focused on avoidance and mitigation, as per Table 2 in the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (SEWPAC 2012). Specific recommendations for the survey area include:
    - Trees that provide significant habitat for Black Cockatoos should be retained if possible during construction; and
    - Avoidance and control of the introduction of pathogens and plant diseases during activities which may negatively impact retained or surrounding habitat of the development.

10 References

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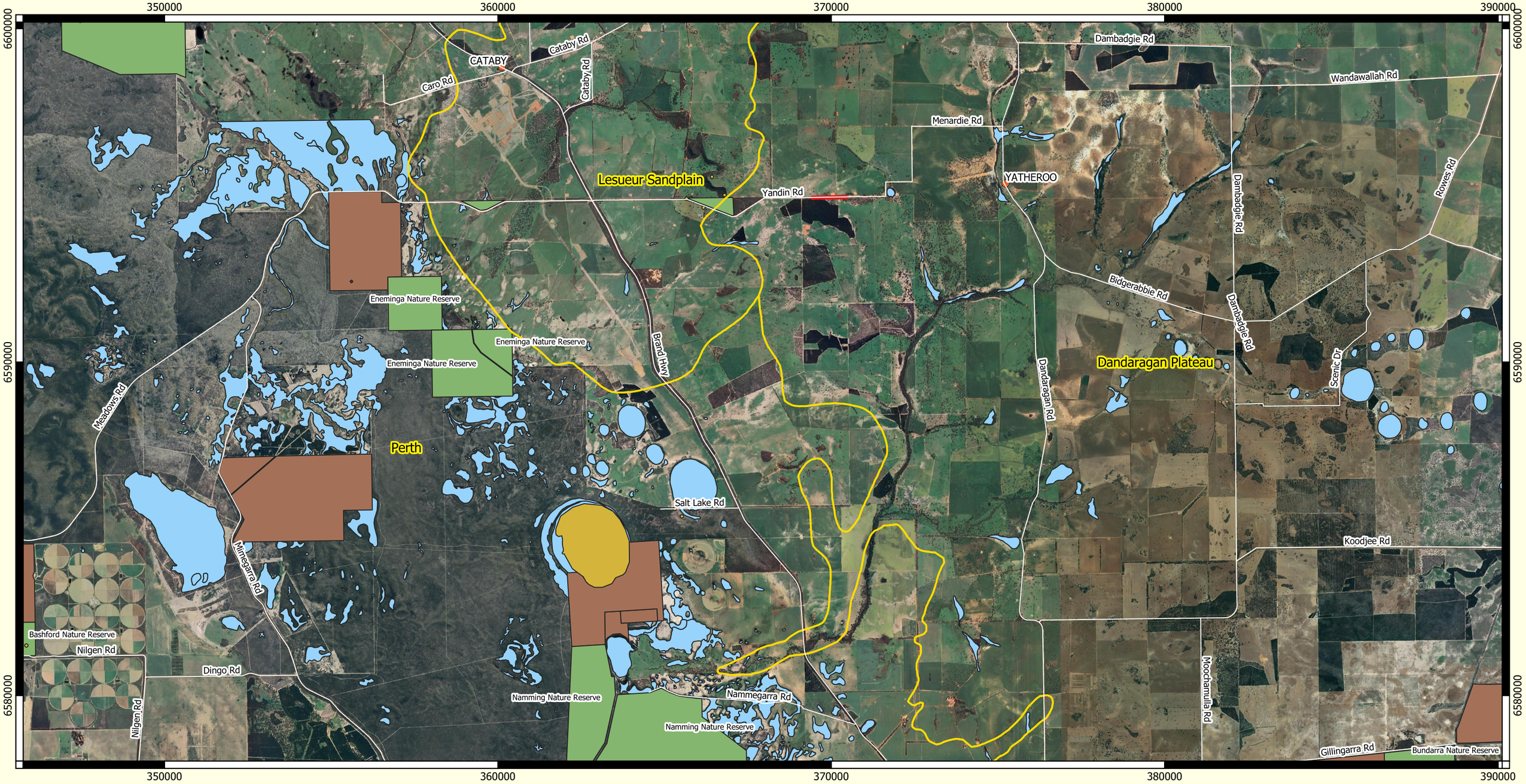
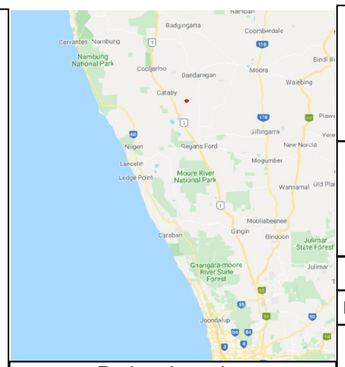
11 Figures



Legend

- Yandin Rd Survey Area
- IBRASubegion_Aust70
- ClearingRegulations_EnvironmentallySensitiveAreasDWER_046
- DBCA_Legislated_Lands_and_Waters
- DBCA_Interest_Lands_and_Waters
- GeomorphicWetlandsSwanCoastalPlainDPAW_017



Project Location

Project Location

Yandin Road Flora Assessment

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:150,00 at A3

Date: 6/11/2019	Prepared: K. Jennings	Project #: T19023
Expiry: N/A	Checked: J. Grehan	
Figure 1	Review:	
	Revision: Rev A	

Terratree

Vegetation Community	Description
Community 1	Closed mixed shrubland of *Banksia hewardiana, Allocasuarina humilis, Lambertia multiflora* subsp. *multiflora, Eremaea pauciflora, Hakea erinacea* and *Babingtonia grandiflora*
Community 2	Open forest of *Corymbia calophylla* over open woodland of *Banksia attenuata* and *B. menziesii* over closed shrubland of *Adenanthos cygnorum, Allocasuarina humilis, Xanthorrhoea preissii, Macrozamia riedleii, Hibbertia hypericoides, H. subvaginata, Stirlingia latifolia, *Ehrharta calycina* and *Pelargonium capitatum*

369500 369750 370000 370250 370500

6595250 6595000 6594750

0 100 200 m

Legend

- Yandin Rd Survey Area
- CPS Subject to Conditions

Priority Flora

- *Anigozanthus humilis* subsp. *chrysanthus* (P4)
- *Banksia dallanneyi* subsp. *pollosta* (P3)

Vegetation Communities

- Community 1
- Community 2
- No vegetation/ Pasture

- Potential Black Cockatoo Foraging Trees

Project Location

Vegetation Communities, Priority Flora Locations and Potential Black Cockatoo Foraging Trees

Yandin Road Flora Assessment

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:4000 at A3

Date: 6/11/2019	Prepared: K. Jennings	Project #: T19023
Expiry: N/A	Checked: J. Grehan	
Figure 2	Review:	Terratree
	Revision: Rev B	

Plates

Plate 1: *Banksia dallanneyi* subsp. *pollosta*

Plate 2: *Anigozanthos humilis* subsp. *chrysanthus*

Plate 3: Tree Waypoint # 174- Evidence of recent foraging on Marri fruit by Carnaby's Black Cockatoo

Plate 4: Tree waypoint # 176- Evidence of recent foraging on Marri fruit by Carnaby's Black Cockatoo

Plate 5: Tree waypoint # 217- Evidence of recent foraging on Marri fruit by Carnaby's Black Cockatoo

Plate 6: Evidence of recent foraging on Banksia attenuata fruit by Carnaby's Black Cockatoo

Appendices

Appendix A: Detailed Vegetation Community Descriptions

Vegetation Type	Description
1	Closed shrub land of *Allocasuarina humilis, Eremaea pauciflora*, *Banksia hewardiana, Hakea ruscifolia, Petrophile brevifolia*, over *Xanthorrhoea preissii*, *Babingtonia grandiflora* and *Banksia dallanneyi* subsp. *pollosta* over **Ehrharta calycina*
	

Vegetation Type	Description
2	Tall Open forest of *Corymbia calophylla* over open woodland of *Banksia attenuata and B menziesii, over closed shrubland of Adenanthos cygnorum, Allocasuarina humilis, Xanthorrhoea preissii, Macrozamia riedleii, Hibbertia hypericoides, H. subvaginata, Stirlingia latifolia, Ehrharta calycina* and Pelargonium capitatum**
	

Appendix B: Conservation Codes for Threatened and Priority Flora and Ecological Communities

Table A 1 – Definition of codes for Threatened and Priority Flora (DPaW)

Code	Definition
T	**Threatened Flora – (Declared Rare Flora – Extant)** 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 (Schedule 1 under the *Wildlife Conservation Act 1950*).
X	**Presumed Extinct Flora (Declared Rare Flora - Extinct)** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such Schedule 2 under the *Wildlife Conservation Act 1950*).
P1	**Priority One – Poorly Known Species** Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	**Priority Two – Poorly Known Species** Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	**Priority Three – Poorly Known Species** Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities 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 localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that 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.
P5	**Priority Five - Conservation Dependent species** Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table A 2 – Definition of codes for Commonwealth Listed Threatened Flora

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

Table A.3 – Definition of codes for Threatened Ecological Communities

Code	Definition
PD: Presumed Totally Destroyed	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant
CR: Critically Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
EN: Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future.
VU: Vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.