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Environmental & Social Consultants

Perth Airport

PERTH AIRPORT SOUTH EAST INFRASTRUCTURE

Flora and Vegetation Assessment

FINAL

October 2024

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Perth Airport

[redacted]

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Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

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	Name	Date	Name	Date
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Executive Summary

Perth Airport is proposing to undertake works involving Western Power infrastructure (powerline poles) ('the Project') located south of Perth Airport, in the vicinity of the Tonkin Highway / Abernethy Road intersection ('the Study Area'). Umwelt were commissioned by Perth Airport to conduct a flora and vegetation assessment of the Study Area for the Project. The survey involved a reconnaissance and targeted survey as defined in Section 4.1 and 4.2 of the Environmental Protection Authority (EPA) Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

The field survey of the Study Area was undertaken in June 2023. This assessment was an out of season survey, with part of the aim being to assess if the area is likely to support significant flora and vegetation not identifiable at the time of survey, based on the vegetation types present and condition of the vegetation. One relevé and seven vegetation observation points were surveyed in the Study Area, with this data used to prepare structural vegetation classification and mapping (including vegetation condition mapping). Targeted survey for significant flora taxa and vegetation was undertaken at approximately 10 m spacings over all suitable habitat for significant flora taxa and vegetation that were identifiable at the time of survey.

A total of 73 discrete vascular flora taxa were recorded in the Study Area by the survey. A total of 16 introduced flora taxa were recorded within the Study Area by the survey. Of these, one is a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and a Weed of National Significance (WoNS) (Weeds Australia, 2023), being *Opuntia stricta* (Common Prickly Pear).

No listed significant flora (excluding planted occurrences of *Grevillea thelemanniana* (T)) were recorded by the survey. All occurrences of *Grevillea thelemanniana* (T) within the Study Are were planted, with this taxon not naturally present in the Study Area. An assessment of the likelihood of occurrence of significant flora taxa identified one taxon which could occur in the Study Area, being *Poranthera moorokatta* (P2). There is potential habitat for this taxon within the area mapped as vegetation type (VT) 1. Given this taxon is an annual species that is present in spring, it was not identifiable at the time of survey, and therefore it may occur in the Study Area (within VT 1 only).

One VT and six highly modified areas were described and mapped in the Study Area. VT 1 is the only area within the Study Area considered to be remnant vegetation. VT 1 is a low open *Banksia menziesii* woodland mapped over a small area adjacent to the Tonkin Highway on-ramp. Highly modified areas covered the majority of the Study Area, sometimes including remnant tree or shrub taxa, but more often being comprised of native species which colonised the area or were planted following disturbance (e.g. in drains). The understoreys were usually completely comprised of introduced taxa.

VT 1 is a small area fragmented by major roads or highways, isolated from other native vegetation areas. Comparison with previous survey data (which included analyses with the Swan Coastal Plain (SCP) datasets) within or adjacent to the Study Area indicate that it is highly likely that VT 1 represents the SCP Floristic Community Type (FCT) 23a (as per the Gibson et. al. (1994) SCP survey), with qualitative comparisons of VT 1 with the Gibson et. al. (1994) report and associated data also indicating that VT 1 would be FCT 23a (not a significant community type). VT 1 meets part of the key diagnostic characteristics for the Banksia Woodlands of the SCP ecological community TEC; however, due to the condition and size of the vegetation,

this area does not meet patch size requirements under the conservation advice for the TEC (DoEE, 2016) (see **Section 5.2.8.1** for this assessment), and is therefore not considered to be an occurrence of the TEC.

An assessment of the likelihood of the remaining 14 significant vegetation communities occurring within the Desktop Study Area identified that it is considered unlikely that any of these significant communities could occur within the Study Area based on a critical review of the community in conjunction with Study Area data; this was mostly due to habitat not being present and/or the required substrate (such as clay soils) are not present.

Based on the results of this study, if substantial impacts are proposed within the area mapped as VT 1, further survey should be undertaken in spring (specifically September) to survey for *Poranthera moorokatta* (P2). In addition, although it is considered likely that VT 1 would align with SCP FCT 23a (as described by Gibson et. al. (1994), the DBCA methods for survey and identification of WA TECs (DBCA, 2023c), require a spring quadrat assessment and analyses of quadrat data to confirm this. The remainder of the Study Area does not contain remnant native vegetation or potential habitat for significant flora. Therefore, if disturbance to VT 1 can be avoided, no further survey is considered to be required.

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1.0 Introduction

1.1 Project Overview

Perth Airport is proposing to undertake works involving Western Power infrastructure (powerline poles) located adjacent to (south of) Perth Airport, in the vicinity of the Tonkin Highway / Abernethy Road intersection (the Project). A flora and vegetation assessment of the areas of vegetation within which the powerline poles are located is required to facilitate the plan of works.

Umwelt were commissioned by Perth Airport to conduct a flora and vegetation assessment for the Project. This report documents all methods from the survey and presents the desktop assessment and results of the field survey.

1.2 Study Area and Desktop Study Area Definitions

A Study Area for the purposes of the flora and vegetation assessment was provided by Perth Airport. The Study Area for the Project is shown on **Figure 1.1**. The Study Area is approximately 3 hectares (ha) in size and consists of cleared areas with existing infrastructure and vegetation.

For the purposes of the desktop study, including interrogation of databases and searches for relevant literature, a Desktop Study Area has also been defined, as shown on **Figure 1.1**. The Desktop Study Area encompasses the Study Area with a 5-kilometre (km) buffer.

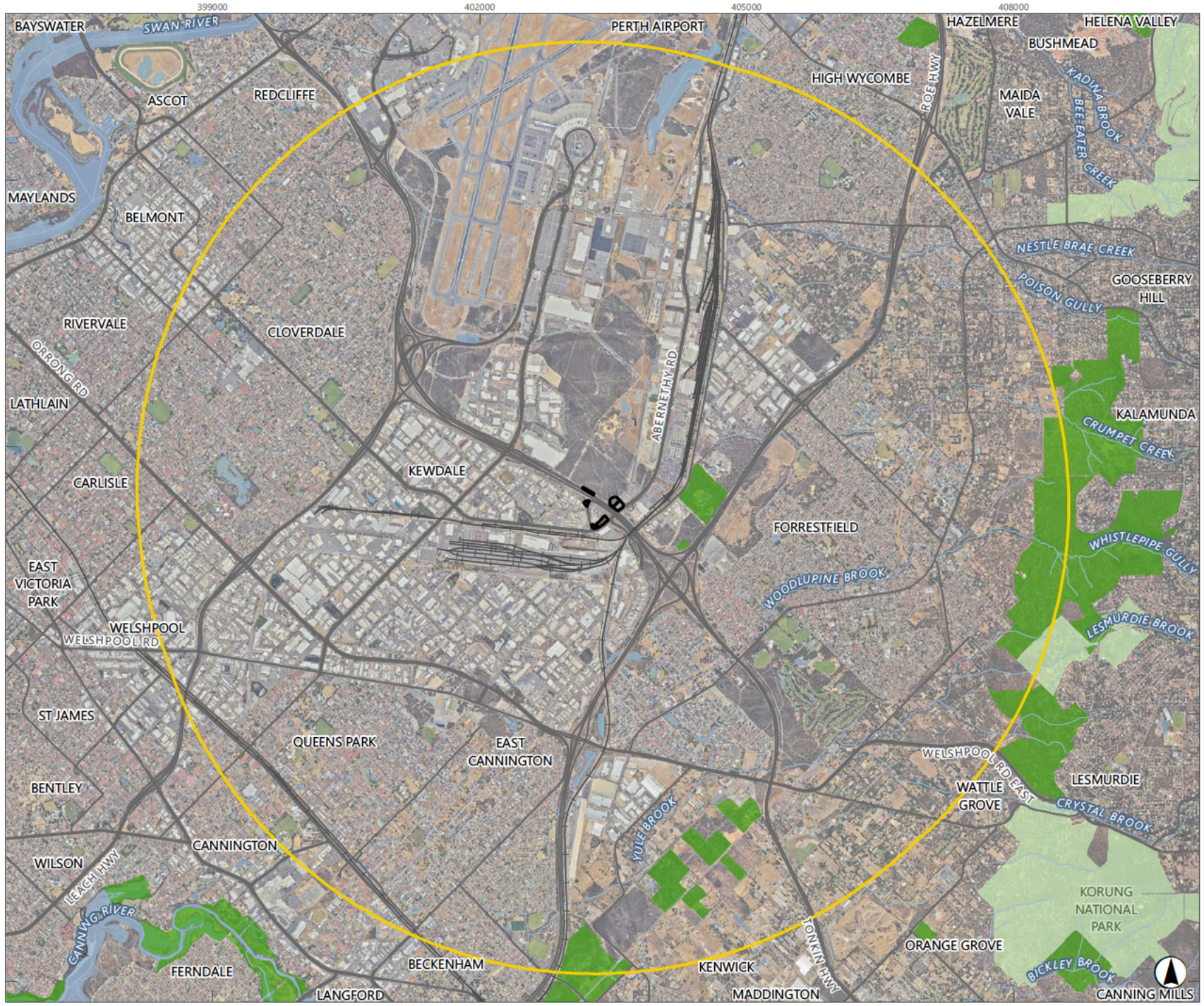


FIGURE 1.1

Project Location

Legend

- Desktop Study Area
- Study Area
- Railway
- Road
- Watercourse
- Waterbody
- Nature Reserve
- National Park

Scale: 1:60,000 at A4
GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

1.3 Aims and Objectives

The primary aim of the survey was to characterise the flora and vegetation values of the Study Area to facilitate the plan of works for the Project.

The primary objectives of the flora and vegetation survey were:

- Identification and mapping of the following significant flora within the Study Area that were identifiable at the time of the survey (**Section 5.2.2**):
    - Listed Threatened Species (T) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth).
    - Threatened Flora (T) listed under the *Biodiversity Conservation Act 2016* (BC Act) (WA).
    - Priority Flora taxa (P) as classified by the WA Department of Biodiversity, Conservation and Attractions (DBCA).
    - Other significant flora taxa as defined by the WA Environmental Protection Authority (EPA) (2016a, 2016b).
- Identify areas which could potentially support any significant flora that were not identifiable at the time of survey (**Section 5.2.3**).
- Map and describe broad vegetation types (VT) and vegetation condition in the Study Area (**Sections 5.2.5** and **5.2.10**).
- Identification of areas that could potentially represent the following significant vegetation within the Study Area (**Section 5.2.8**):
    - Threatened Ecological Communities (TEC) listed under Commonwealth legislation or classified by DBCA and endorsed by the WA Minister for the Environment.
    - Priority Ecological Community (PEC) as classified by DBCA.
    - Other significant vegetation as defined by EPA (2016a, 2016b).

1.4 Level of Assessment

The flora and vegetation survey involved a reconnaissance and targeted survey as defined in Section 4.1 and 4.2 of the 'Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA, 2016b). This level of survey is considered the appropriate level of survey, based on the size of the area, the disturbance history over the area and the timing of the survey (out of season survey as discussed in **Section 3.3.1**).

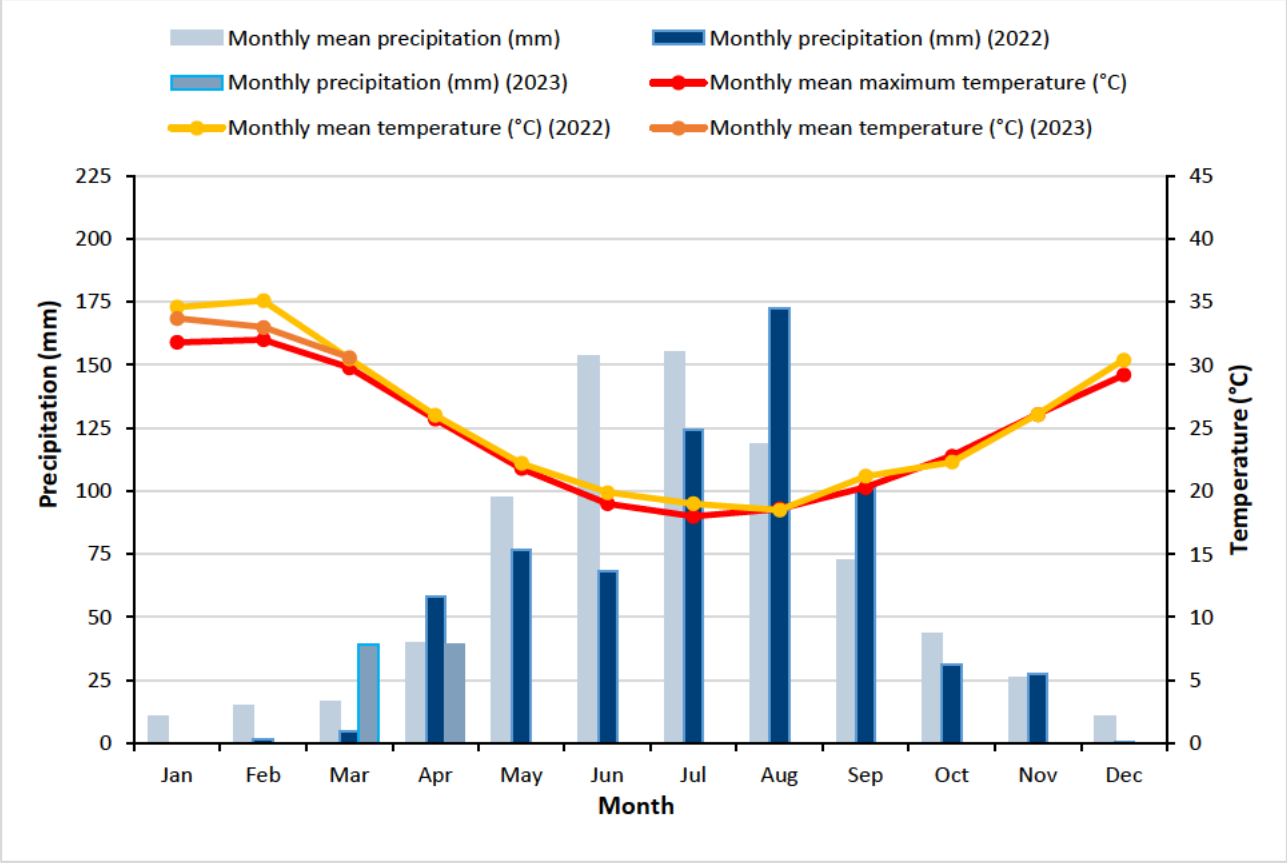
2.0 Background

2.1 Climate

The Study Area is located in the Swan Coastal Plain (SCP) region (Darling Botanical District), within the Southwest Botanical Province as defined by Beard (2015). The climate of the SCP region is classified as warm Mediterranean, with predominantly winter precipitation (600 – 1000 millimetres (mm)) and five to six dry months per year (Beard, 2015).

Graph 2.1 presents monthly precipitation totals and monthly maximum temperature statistics for 2022 to 2023, as well as long-term average monthly precipitation and maximum temperature data recorded at Bureau of Meteorology (BoM) Perth Airport station (station number 9021; data from 1944 to 2023) (BoM, 2023), the most relevant meteorological station to the Study Area with long-term climate data.

Perth Airport receives an annual average of 760 mm of rainfall, the majority of which occurs from June to August. Long-term average monthly maximum temperatures generally peak from December to March (29 °C to 32 °C). The rainfall received in 2022 was below average (668 mm compared to the long-term average of 760 mm), with rainfall received in 2023 prior to survey (January to April) slightly below average (79 mm compared to the long-term average of 82 mm). Temperatures in 2022 and in the warmer months preceding the survey in 2023 were slightly above the long-term averages.



Graph 2.1 Temperature and Precipitation for Perth Airport (BoM, 2023)

2.2 Land Tenure

The Study Area is situated within the City of Belmont and comprises Crown reserve, private property, easements and public road as presented on **Figure 2.1**. There are no DBCA reserves within the Study Area; however, several reserves and part of a National Park occur within the Desktop Study Area (see **Figure 1.1**).

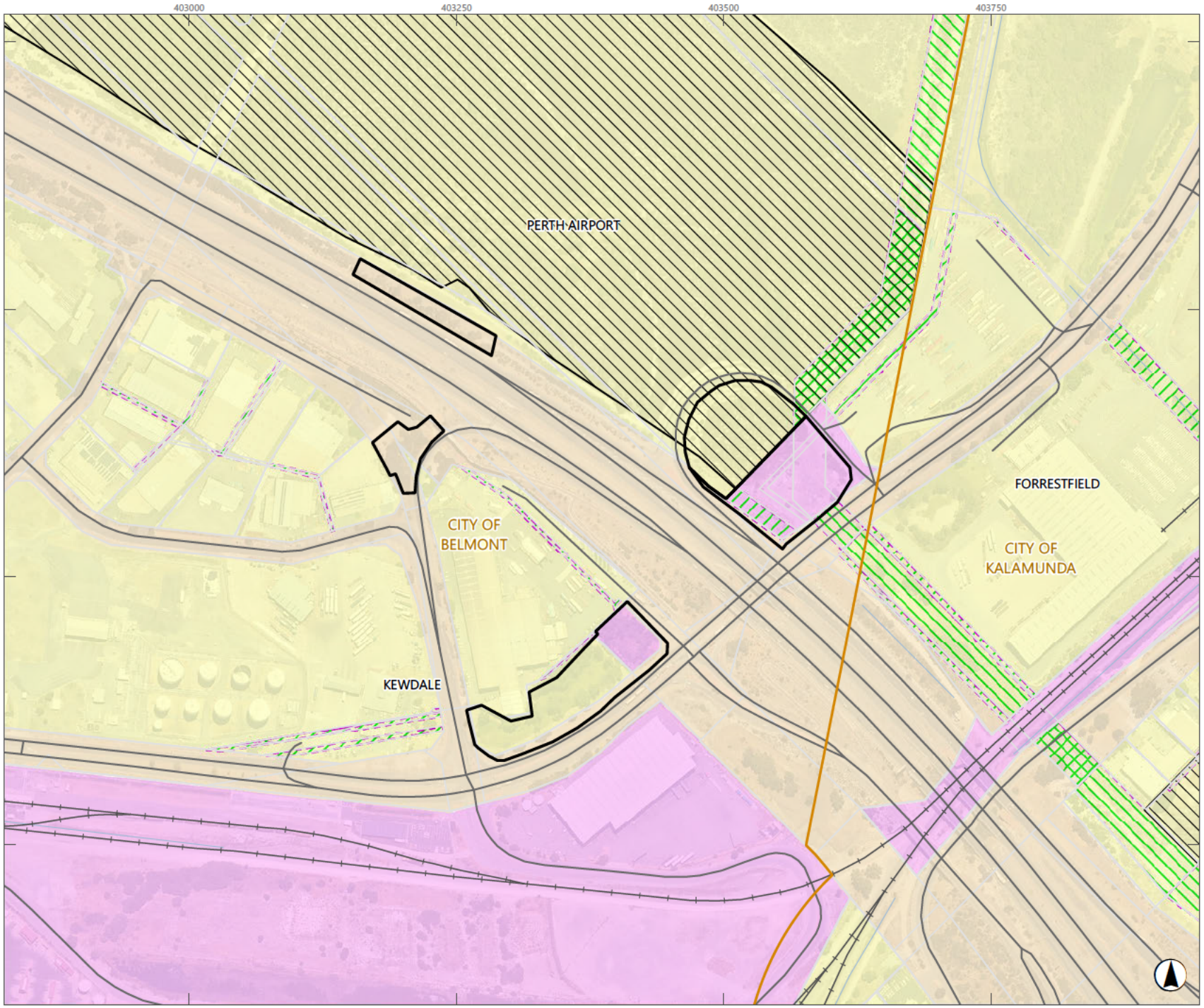


FIGURE 2.1

Land Tenure of the Study Area

Legend

- Study Area
- Railway
- Road
- Watercourse
- Local Government Area Boundary
- Bushland Forever Areas, 2000
- Property Boundary
- Easements
- Other Interests
- Crown Reserve
- Public Road
- Crown Allotment (Type 2)
- Lot on Survey (Type 1)

0 100 200

Meters

Scale: 1:5,000 at A4

GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DPLH (2000)

3.0 Methods

3.1 Desktop Assessment

Prior to commencement of the field survey, a review of publicly available flora and vegetation data relevant to the Study Area was undertaken. This included obtaining and reviewing copies of reports of previous flora and vegetation surveys undertaken within the vicinity of the Study Area (where available) (including interrogation of the Index of Biodiversity Surveys for Assessments (IBSA) website) and interrogation of relevant databases and other sources as listed in **Table 3.1**. Where TECs or PECs were identified by the desktop assessment, appropriate nomination/listing descriptions and recovery plans of the TEC or PEC were also reviewed prior to field survey, as well as the 'Methods for survey and identification of Western Australian threatened ecological communities' report from DBCA (DBCA, 2023c).

Table 3.1 Searches undertaken for the Desktop Assessment of the Study Area

Source	Search Attributes	Search Purpose
DBCA Significant Flora Databases (WA Herbarium specimen database and Threatened and Priority Flora (TPFL) database) (DBCA, 2023b)	Desktop Study Area boundary	Obtain records of DBCA-listed significant flora within the Desktop Study Area.
DBCA TEC and PEC lists (DBCA, 2018, 2023e)	Manual review of current DBCA TECs and PECs listed for the SCP and Southwest region	Identify whether there are any DBCA-listed TECs or PECs that could occur within the Desktop Study Area.
DBCA Threatened and Priority Ecological Communities Database (DBCA, 2023a)	Desktop Study Area boundary	Obtain records of DBCA-listed TECs and PECs within the Desktop Study Area.
Department of Climate Change, Energy, the Environment and Water (DCCEEW)) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool) (DCCEEW, 2023)	Desktop Study Area boundary	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs listed under the EPBC Act, that occur or have the potential to occur within the Study Area.
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (report 3b) (DBCA, 2019)	Study Area boundary	Identify extent of Vegetation System Associations (VSAs) within the Desktop Study Area.

3.2 Personnel and Licensing

Table 3.2 lists the personnel involved in both fieldwork and plant identifications for the flora and vegetation assessment. The field team leader has had significant previous experience (> 15 years) in conducting flora and vegetation surveys in WA, including similar flora surveys in the SCP IBRA region. Other field personnel have previous experience (> 10 years) in undertaking flora and vegetation surveys in WA (including the SCP).

All plant material was collected under the relevant Flora Taking (Biological Assessment) Licence (under Regulation 62 of the Biodiversity Conservation Regulations 2018 (BC Regs)) and Authorisation to Take or Disturb Threatened Species (pursuant to Section 40 of the BC Act) as outlined in **Table 3.2**. Personnel undertaking plant identifications have had extensive previous experience (> 15 years) in plant identifications for flora of the SCP IBRA region.

Table 3.2 Personnel and Licensing Information

Personnel	Flora Collecting Permit (BC Regs/BC Act)	Role
[redacted] BSc (Environmental Biology) (Hons)	FB62000051-2 TFL 131-2122	Field Team Leader Plant Identifications
[redacted] BSc (Environmental Biology) (Hons)	FB62000048-2 TFL 129-2122	Field Team Member

3.3 Field Survey Methods

3.3.1 Survey Timing and Access

The field survey of the Study Area was undertaken on 13 June 2023. The field survey does not coincide with the most appropriate time to survey in the South West province as per EPA Technical Guidance (EPA, 2016b), with flora and vegetation surveys in this region typically undertaken in spring (September to November), coinciding with when most of the taxa are in flower.

Due to survey timing requirements, sampling of the Study Area with quadrats and subsequent analysis with the DBCA SCP datasets (a requirement for the identification of many TECs and PECs that occur on the SCP) was not undertaken during this assessment. Targeted significant flora survey was only undertaken for perennial taxa that are identifiable during the survey. It is considered that the reconnaissance and targeted survey will serve to identify any areas that may require sampling via quadrats (dependent on condition of the vegetation), and any suitable habitat for significant flora taxa that were not identifiable during the survey period.

The Study Area was accessed by foot transects. Note that some parts of the Study Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be assessed visually.

Appropriate landholder/manager permissions were obtained prior to undertaking field survey.

3.3.2 Sample Sites

One relevé and seven vegetation observation points were surveyed in the Study Area. Sample site locations were recorded using handheld Global Positioning System (GPS) units (Geocentric Datum of Australia (GDA) 2020, Zone 50). The area of survey for the relevé covered a radius of approximately 10 m around a central point. Dominant vascular flora taxa (native and introduced) that were visually identifiable in each stratum level were recorded. Specimens of unknown taxa encountered were collected for verification and identification purposes (see **Section 3.3.4**). The following additional information was recorded at the relevé:

- Personnel
- GPS coordinates at centre of relevé
- Site photograph
- Topography
- Soil colour and type (including the presence of any rock outcropping and surface stones)
- Vegetation condition (EPA, 2016b); scale presented in **Section 3.3.6**)
- Approximate time since fire
- Structural description of vegetation (see **Section 3.3.5**).

Vegetation observation points were recorded in areas where the vegetation had been highly modified. These points included recording a GPS location at the point where the notes were taken and a brief description of the vegetation, including dominant and characteristic taxa, vegetation condition (**Section 3.3.5**) and photograph. The notes were used to aid in describing the vegetation and condition within the Study Area.

3.3.3 Targeted Survey

Targeted survey for significant flora taxa and vegetation was undertaken over all suitable habitat within the Study Area. Significant flora taxa and vegetation that were identifiable at the time of survey (as identified by the desktop assessment and considered to have potential to occur within the Study Area) were targeted (**Section 5.1.3**). Targeted survey was undertaken on foot in a grid pattern, at approximately 10 m intervals. If individuals of known significant flora taxa were identified, a representative collection of material was made, and the abundance and spatial distribution of individuals was recorded (spatial data recorded using a standard Garmin GPS). Survey extended outside the Study Area if the population was observed to continue outside these areas (where practicable).

All traverses and sampling points (relevés and vegetation observation points) in the Study Area are mapped in **Figure 3.1**.

FIGURE 3.1

Survey Track Logs and Sampling Locations

Legend

- Study Area
- Railway
- Road
- Watercourse
- Local Government Area Boundary
- Property Boundary
- Relevé
- Vegetation Observation Points
- Survey Track Logs

0 60 120

Meters

Scale: 1:3,000 at A4

GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023)

3.3.4 Plant Collection and Identification

Specimens of any unknown flora taxa encountered during the field survey were collected and pressed as per Western Australian Herbarium (WA Herbarium) guidelines (WA Herbarium, 2020). Plant identifications were undertaken at the WA Herbarium by a Principal Ecologist - Botanist with extensive previous experience (> 15 years) in plant identifications for flora of the SCP region (**Section 3.2**). The identification of all flora taxa used the most up to date information available, including taxonomic keys published in books, journals and online, comparison with herbarium specimens, and consultation with taxonomic experts. External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest, including botanists at the WA Herbarium.

Taxon nomenclature generally follows Florabase (WA Herbarium, 1998-), with all names checked against the current DBCA Max database to ensure their validity. However, in cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on Florabase due to time constraints, nomenclature in the published literature is followed. The conservation status of each taxon was checked against Florabase, which provides the most up-to-date information regarding the conservation status of flora taxa in WA.

As per section 7.2 of EPA Technical Guidance, specimens of interest, including significant flora taxa, taxa representing range extensions, potential new taxa, and key species in new occurrences of TECs and PECs will be sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms (TPFRFs) submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (i.e. Threatened and Priority flora taxa).

3.3.5 Vegetation Definition, Mapping and Description

Vegetation in the Study Area was mapped and described using structural vegetation classification as described in Section 8.1 of the EPA Technical Guidance (EPA, 2016b). Vegetation community descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (Executive Steering Committee for Australian Vegetation Information (ESCAVI) , as stipulated by EPA (2016b). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data are produced nation-wide.

The locations of the sample sites were used in conjunction with aerial photograph interpretation and field notes taken during survey to develop VT polygon boundaries. Mapping boundaries were delineated using aerial photography, and were then digitised using Geographic Information System (GIS) software.

3.3.6 Vegetation Condition Mapping

Vegetation condition was described using the vegetation condition scale presented in EPA Technical Guidance (2016b) for the South-West and Interzone Botanical Provinces (**Table 3.3**). Notes on vegetation condition were taken during the field survey during foot traverses undertaken within the Study Area. Vegetation condition was also recorded at relevé and vegetation observation point locations. Vegetation condition category polygon boundaries were developed using this information in conjunction with introduced flora taxa location data and were digitised using GIS software as for vegetation polygon boundaries.

Table 3.3 Vegetation Condition Scale for the South-West and Interzone Botanical Provinces

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

3.3.7 Significant Flora

As per EPA definitions (2016a), flora taxa may be significant for a range of reasons, including, but not limited to the following:

- being identified as a Threatened or Priority species (formally listed significant taxa – includes taxa listed under both State and Commonwealth legislation, and classified as Priority by DBCA)
- being locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- being a new species or having anomalous features that indicate a potential new species
- being representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- being an unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- having a relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant flora taxa recorded within the Study Area are discussed in **Section 5.2.2** with reference to the above categories. Data including point locations and individuals of significant flora recorded in the Study Area are also presented in this section.

DBCA (2020) presents conservation codes for DBCA-listed taxa. Further information about Commonwealth conservation categories is provided in Threatened Species Scientific Committee's (TSSC) 'Guidelines for assessing the conservation status of native species according to the *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000' (TSSC, 2021).

3.3.8 Significant Vegetation

As per EPA definitions (2016a), vegetation may be significant for a range of reasons, including, but not limited to the following:

- being identified as a TEC or PEC (formally listed significant vegetation – includes vegetation listed under Commonwealth or State legislation, or classified as a PEC by DBCA)
- having restricted distribution
- having a degree of historical impact from threatening processes
- playing a role as a refuge
- providing an important function required to maintain ecological integrity of a significant ecosystem.

As outlined in **Section 3.3.1** and **3.3.5**, due to survey timing, this assessment mapped and described the vegetation via structural vegetation classification via relevé and vegetation observation point data, with no floristic data analysis undertaken. This does not align with the methodology to be used when assessing the significance of vegetation on the southern SCP (as per DBCA's 'Vegetation survey methods and analysis to determine floristic community types on the southern Swan Coastal Plain' (DBCA, 2023c)), which involves analyses of quadrat data with the Gibson et al. (1994) and Keighery et al. (2012) datasets. However, a qualitative assessment of the Floristic Community Types (FCTs) described by the Gibson et al. (1994) study was undertaken to ascertain if a quadrat assessment is likely to be required based on the vegetation types present and condition of the vegetation.

4.0 Limitations of the Survey

Table 4.1 presents the limitations of the flora and vegetation assessment of the Study Area in accordance with the requirements of EPA Technical Guidance (EPA, 2016b). The survey timing is considered to be a potential minor limitation of the survey, but is otherwise not considered to have significantly impacted the results of the flora and vegetation survey.

Table 4.1 Limitations of the Flora and Vegetation Survey

Limitation	Outcome	Comment
Effort and Extent	Not a limitation	A reconnaissance survey was undertaken across the entire Study Area. One relevé and seven vegetation observation points were recorded within the Study Area. A single relevé is considered adequate to characterise the flora and vegetation of the Study Area given the limited amount of remnant vegetation present and the size of the Study Area. Systematic targeted survey for all significant flora taxa identified by the desktop assessment was conducted in all suitable habitat across the entire Study Area. Mapping of vegetation boundaries was undertaken using a combination of aerial photography and information collected at the relevé and vegetation observation points. No constraints prevented appropriate sampling techniques (relevé establishment, foot traverses) being employed. Most areas were easy to access using roads and tracks. Some parts of the Study Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be assessed visually. Data reliability is therefore considered to be relatively high.
Competency/experience of the team carrying out the survey	Not a limitation	The field team leader for the field survey has > 15 years' experience in conducting flora and vegetation surveys in the SCP, and field assistant has >10 years' experience conducting flora and vegetation surveys in the SCP. Information relating to identifying characteristics of significant flora taxa and vegetation identified by the desktop assessment as potentially occurring in the Study Area was provided to all field team members prior to undertaking the field survey. The plant identifications were undertaken by a Principal Ecologist – Botanist with > 15 years' experience in plant identification for flora of the South-West and SCP.
Proportion of flora identified, recorded and/or collected	Potential minor limitation	All vascular groups that were present in the Study Area were sampled. A high proportion of perennial vascular taxa were recorded based on the intensity and method of survey. Annual vascular taxa were recorded where identifiable; however, additional annual taxa would be expected to be present in the Study Area during the peak flowering season for the region (spring). However, the survey aimed to search for perennial taxa that are identifiable at the time of survey, as well as to assess the area for suitable habitat for significant flora taxa that are not identifiable during the survey period. Therefore, while this is a minor limitation of the reconnaissance and targeted survey, this is not considered to be a limitation with respect to the aims of this assessment. Any unknown vascular taxa were collected, and identified by a highly experienced Principal Ecologist – Botanist.

Limitation	Outcome	Comment
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Not a limitation	Good contextual information for the Study Area was available prior to the survey. Sources of information used included government databases (DBCA, DCCEEW), as well as numerous general sources pertaining to the climate, geomorphology, flora and vegetation of the region, and flora and vegetation surveys previously conducted in the Desktop Study Area.
Timing/weather/ season/cycle	Potential minor limitation	The field survey was conducted in June 2023. This does not correspond to the optimum survey or flowering period for the SCP bioregion. However, as mentioned above, given the survey aimed to search for identifiable perennial taxa, and assess for suitable habitat for significant flora taxa (taxa not identifiable during the survey period), this is a minor limitation of the reconnaissance and targeted survey, but not a limitation with respect to the aims of this assessment.
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	Not a limitation	There was evidence of significant impact to vegetation composition and structure throughout the Study Area as a result of human activities, including clearing and very high levels of introduced (weed) taxa. However, these disturbances did not affect the results of the survey, with the vegetation able to be confidently described and mapped, and flora taxa mature enough to be easily identified or collected.
Remoteness and/or access problems	Not a limitation	The Study Area was accessed either via roads and on foot. Some parts of the Study Area were not able to be accessed during the field survey due to being inundated with water; however, the vegetation in these areas was able to be assessed visually. Therefore, this is not considered to be a limitation of this assessment.

5.0 Results

5.1 Desktop Assessment

5.1.1 Regional Vegetation

The vegetation of WA as it was presumed to have existed prior to European settlement has been mapped at a scale of 1:250,000 as vegetation system associations (VSAs) (DBCA, 2019), with the pre-European Vegetation spatial database subsequently created (Beard et al., 2013; DPIRD, 2019). The Study Area occurs on one VSA, being the Bassendean_1018. **Table 5.1** presents the current extent of this VSA in relation to its pre-European extent within the Perth (SWA-02) IBRA subregion, and the percentage of the current extent of the VSA currently protected for conservation in all DBCA-managed land (as a proportion of the current extent) within the Perth (SWA-02) IBRA subregion (DBCA, 2019). Note that as per DBCA's Statewide Vegetation Statistics Report (DBCA, 2019), protected areas in this context are considered to be any areas listed in DBCA-Legislated Lands and Waters dataset as either Crown reserves or lands managed under Section 8A of the *Conservation and Land Management Act 1984* that have an International Union for Conservation of Nature (IUCN) category of I to IV.

The Bassendean_1018 VSAs has 14.9 % of its pre-European extent remaining, 1.1 % of which occurs within reserves (**Table 5.1**).

Table 5.1 Vegetation Systems Associations of the Study Area

VSA	Description	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent Protected for Conservation (%)	Area (ha) in Study Area
Bassendean_1018	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; *Casuarina obesa*	1,195	14.9	1.1	3.0

5.1.2 Local Flora and Vegetation Surveys

A number of flora and vegetation survey reports that are publicly available have been undertaken within the vicinity of the Study Area as outlined in **Table 5.2**. This includes numerous flora and vegetation surveys that have been undertaken at the Perth Airport Estate, which is located adjacent to (north of) the Study Area; however, only more recent surveys and surveys relevant to the Study Area have been included in **Table 5.2**.

There has been one (publicly available) flora and vegetation survey that has been undertaken within the Study Area itself. Biota (2003) undertook a flora and vegetation assessment of the Tonkin Highway on-ramp prior to clearing/construction. This included a quadrat assessment and external statistical analyses of quadrat data with the SCP FCT Gibson et. al dataset (1994) by Trudgen (2003), as described in **Table 5.2**.

Table 5.2 Summary of Local Flora and Vegetation Surveys Previously Conducted within and in the Vicinity of the Study Area

Report Title and Author	Scope	Key Findings

Abernethy Road – Tonkin Highway On-Ramp Public Environmental Review (Biota, 2003)	Targeted significant flora surveys and confirmation of vegetation boundaries – overlaps part of the Study Area	• Recorded 173 vascular plant taxa (including those recorded by previous studies over the area (Ecologia, 1998; 1999))
		• Assessed 7 new quadrats and rescored 3 previously surveyed Ecologia quadrats, 3 of which occur within the current Study Area (AR02, AR03 and AR05)
		• Recorded two locations *Macarthuria keigheryi* (T), located 400 m N and 120 m NNW of the on-ramp area
		• Recorded a single location of *Platysace ramosissima* (P3), located 80 m N of the on-ramp area
		• Recorded a single location of *Verticordia lindleyi* subsp. *lindleyi* (P4), located within the on-ramp impact area
		• Mapped and described five VTs, two of which occur within the Study Area:
		  ○ *Pericalymma ellipticum* var. *ellipticum* shrubland on sumplands (quadrat AR03)
		  ○ *Banksia menziesii* woodland over mixed low shrublands on low sandy rises (quadrats AR02 and AR05).
		• Included a separate appendix with the results of an analysis of Biota quadrat data with SCP FCT Gibson et al. (1994) sites (production of a dendrogram using FUSE and DEND modules of PATN and nearest neighbour analysis using NNB module of PATN), undertaken by Trudgen (2003), with Trudgen concluding:
		  ○ AR03 to be referrable to SCP FCT 4
		  ○ AR02 and AR05 to be referrable to SCP FCT 23a.
		• Did not record any TECs or PECs (based on listings at the time of reporting), although based on a review of the description, umwelt consider it likely that the *Banksia menziesii* community would be representative of the Banksia Woodland TEC.

Perth Airport Commonwealth Conservation Significant Flora and Vegetation Survey (Strategen, 2018)	Detailed flora and vegetation survey, and targeted significant flora surveys of the Perth Airport Estate - adjacent (north of) the Study Area	• Recorded 196 vascular plant taxa; • Recorded two Threatened taxa: *Conospermum undulatum* and *Macarthuria keigheryi*; • Recorded two Priority taxa: *Jacksonia gracillima* (P3) and *Verticordia lindleyi* subsp. *lindleyi* (P4); • Maintained the previous community descriptions produced by previous consultants (i.e. did not define any new community types); may have modified community mapping boundaries, however this is not clear in the report; • Mapped 130.7 ha of the Banksia Woodlands of the Swan Coastal Plain TEC (Endangered - Commonwealth), and inferred that some areas of this TEC were equivalent to the following significant vegetation: 'SCP20a - *Banksia attenuata* woodland over species rich dense shrublands' (Endangered – W.A.) and 'Low lying *Banksia attenuata* woodlands or shrublands ('floristic community type 21c')' (P3 – WA).
Perth Airport Estate Updated Flora and Vegetation Assessment–	Detailed and targeted flora and vegetation survey of the Perth Airport Estate –	• Recorded 468 vascular plant taxa; • Recorded two Threatened taxa: *Conospermum undulatum* and *Macarthuria keigheryi*;

Report Title and Author	Scope	Key Findings
Perth Airport (Woodman Environmental, 2020)	adjacent (north of) the Study Area	• Recorded 12 Priority taxa: *Isopogon autumnalis* (P3), *Jacksonia gracillima* (P3), *Jacksonia sericea* (P4), *Johnsonia pubescens* subsp. *cygnorum* (P2), *Myriophyllum echinatum* (P3), *Poranthera moorokatta* (P2), *Schoenus benthamii* (P3), *Schoenus pennisetis* (P3), *Stylidium aceratum* (P3), *Styphelia filifolia* (P3), *Stylidium longitubum* (P4), and *Verticordia lindleyi* subsp. *lindleyi* (P4); • Mapped and described 14 VTs; • Recorded three listed significant vegetation communities: o SCP3b - *Corymbia calophylla* - *Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (Vulnerable – WA) o SCP15 – Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (Vulnerable – WA) o Banksia Woodlands of the Swan Coastal Plain (P3 – WA, Endangered – Commonwealth).
Tonkin Grade Separated Interchanges Biological Survey and Targeted Black Cockatoo Habitat Assessment – Main Roads WA (Woodman Environmental, 2021)	Detailed and targeted flora and vegetation survey of Tonkin Highway (from south of Roe Highway to Maddington Rd) – 1.2 km SE of the Study Area	• Recorded 355 vascular plant taxa; • Recorded four Threatened taxa: *Andersonia gracilis*, *Banksia mimica, Conospermum undulatum* and *Morelotia australiensis*; • Recorded seven Priority taxa: *Byblis gigantea* (P3), *Isopogon autumnalis* (P3), *Jacksonia gracillima* (P3), *Johnsonia pubescens* subsp. *cygnorum* (P2), *Lasiopetalum bracteatum* (P4), *Styphelia filifolia* (P3) and *Verticordia lindleyi* subsp. *lindleyi* (P4); • Mapped and described seven VTs; • Two significant vegetation communities were identified and mapped in the Survey Area and three additional significant vegetation types were identified as potentially occurring in the Survey Area (more data was required to confirm the occurrences) including: o SCP20a - *Banksia attenuata* woodland over species rich dense shrublands (Endangered - WA, forms part of the Commonwealth TEC 'Banksia woodlands of the Swan Coastal Plain'); o Banksia woodlands of the Swan Coastal Plain (Endangered - Commonwealth; Priority 3 – WA); o Potential SCP20c – Shrublands and Woodlands of the eastern side of the Swan Coastal Plain (Endangered - Commonwealth; Critically Endangered – WA); o Potential SCP3a – *Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain (Endangered - Commonwealth; Critically Endangered – WA) o Potential SCP3c – *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (Endangered - Commonwealth; Critically Endangered – WA).

5.1.3 Significant Flora Taxa

The interrogation of the DBCA TPFL Database and WA Herbarium (WAHerb) Specimen Database (DBCA, 2023b) returned a total of 48 listed significant vascular flora taxa that have records in the Desktop Study Area. Of these, 16 taxa are listed as Threatened under the EPBC Act and BC Act, with the remaining 33 taxa being DBCA-classified Priority flora (**Table 5.3**). Records of these taxa are presented in **Figure 5.1**.

One additional Priority flora taxon, *Melaleuca viminalis* (P2), was returned by the search; this taxon is widely cultivated and is not considered to be indigenous to the Perth area (likely a garden escapee or weed), however is considered indigenous to the Kimberley region and is known from a very small number of locations, hence its Priority status in WA (Craven et al., 2010). Therefore, it is not included in **Table 5.3** and is not discussed further in the context of significant flora.

The search of the DCCEEW SPRAT Database (DCCEEW, 2023) with regard to MNES listed under the EPBC Act identified 32 flora taxa listed as Threatened species, or habitat for such species, that may occur in the Desktop Study Area (**Table 5.3**). The full results of the DCCEEW Database search are presented in **Appendix A**.

A total of 67 significant flora taxa (34 Threatened taxa and 33 DBCA-classified Priority flora) potentially occur or are known to occur (based on presence of potential habitat) within the Desktop Study Area, as presented in **Table 5.3**. None have known records within the Study Area itself.

Table 5.3 Significant Flora Taxa Known from the Desktop Study Area

Taxon	Status (WA)	Source	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)
Acacia anomala	T	DCCEEW	August to September	Lateritic soils on hill slopes.
Acacia aphylla	T	DCCEEW	August to October	Granite outcrops and hills on sand, loam or clay loam.
Andersonia gracilis	T	DBCA, DCCEEW, WEC	October to November	Winter-wet sandy clay flats and depressions.
Anigozanthos viridis subsp. *terraspectans*	T	DCCEEW	August to October	Winter-wet clay flats and depressions.
Anthocercis gracilis	T	DCCEEW	September to October	Granite outcrops on sandy or loamy soils.
Aponogeton hexatepalus	P4	DBCA	February, May to November	Brown, grey or black clay. Growing in shallow water in major drainage lines and wetlands, claypans.
Austrostipa bronweniae	T	DBCA, DCCEEW	April or October	Seasonally inundated damplands and wetlands with sandy clay or loam.
Babingtonia urbana	P3	DBCA	December to March	Brown clay loam and sand. Winter-wet flats and wetlands.
Banksia mimica	T	DBCA, DCCEEW, WEC	December, January to February	Flats and lowerslopes on white or grey sand over laterite, sandy loam.
Banksia pteridifolia subsp. *vernalis*	P3	DBCA	September to October	White/grey sand over laterite, usually on plains or lower slopes.

Taxon	Status (WA)	Source	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)
Byblis gigantea	P3	DBCA, WEC	September to January	Sandy-peat swamps. Seasonally wet areas.
Caladenia huegelii	T	DBCA, DCCEEW	September to October	Grey sand dunes.
Calandrinia uncinella	P1	DBCA	September to October	Seasonally wet flats and wetlands with silty loam or clay.
Calectasia grandiflora	P2	DBCA	June to November	Swamps, wetlands and seasonally moist flats with sandy clay.
Calytrix breviseta subsp. *breviseta*	T	DBCA, DCCEEW	October to November	Winter wet clay flats and depressions.
Chamelaucium lullfitzii	T	DCCEEW	September to December	Usually orange-yellow sand (occasionally grey), sometimes with gravel, on hill slopes.
Comesperma rhadinocarpum	P3	DBCA	October to January	Sand or sandy loam with laterite. Slopes, undulating plains and flats.
Conospermum undulatum	T	DBCA, DCCEEW, Strategen, WEC	May to October	Sand and sandy clay soils, often over laterite, on flat or gently slopes.
Darwinia apiculata	T	DCCEEW	October	Flats and hills with laterite or granite on sandy loam or clay.
Diplolaena andrewsii	T	DCCEEW	August to October	Granite outcrops on hill slopes.
Diuris drummondii	T	DCCEEW	November to January	Swamps, often in shallow water.
Diuris micrantha	T	DCCEEW	September to October	Swamps, often in shallow water.
Diuris purdiei	T	DBCA, DCCEEW	September to October (only after fire)	Swampy flats.
Drakaea elastica	T	DCCEEW	October to November	Grey sand flats adjacent to swamps.
Drakaea micrantha	T	DCCEEW	September to October	Grey sand flats adjacent to swamps.
Drosera occidentalis	P4	DBCA	October to November	Swampy or damp flats, sandy floodplain.
Eleocharis keigheryi	T	DCCEEW	August to November	Swamps, in fresh water.
Eremophila glabra subsp. *chlorella*	T	DBCA, DCCEEW	July to November	Winter wet clay flats and depressions.
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3	DBCA	September to November	Grey, brown or black sand or clay. Winter-wet flats and claypans.
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	DBCA	September to January	Grey clay. Winter-wet flats, claypans and swamps.

Taxon	Status (WA)	Source	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)
Eucalyptus x balanites	T	DCCEEW	October to December or January to February	Hills and plains with sand and sandy loam, often with laterite.
Goodenia arthrotricha	T	DCCEEW	October to November	Granite rocks and slopes.
Grevillea curviloba subsp. *incurva*	T	DCCEEW	August to September	Sand, sandy loam. Winter-wet flats.
Grevillea flexuosa	T	DCCEEW	July to October	Breakaways and slopes with laterite.
Grevillea thelemanniana	T	DBCA, DCCEEW	October to November	Slopes and crests with granite or laterite on gravel and brown sandy loam or clay.
Haemodorum loratum	P3	DBCA	November	Grey or yellow sand, gravel. Plains, lower slopes.
Hydrocotyle lemnoides	P4	DBCA	August to October	Swamps.
Isopogon autumnalis	P3	DBCA, WEC	February to June	Grey or yellow sand, sometimes with laterite gravel. Plains, flats, lower slopes.
Jacksonia gracillima	P3	DBCA, Strategen, WEC	October to November	Sandy flats and in wetlands.
Johnsonia pubescens subsp. *cygnorum*	P2	DBCA, WEC	September	Flats, seasonally-wet sites with grey-white-yellow sand.
Lasiopetalum bracteatum	P4	DBCA, WEC	September to February	Brown or yellow clayey sand, sometimes over granite. Hilltops, slopes and drainage lines.
Lasiopetalum glutinosum subsp. *glutinosum*	P3	DBCA	September to December	Sandy loam or clay with granite. Granite outcrops and slopes.
Lepidosperma rostratum	T	DBCA, DCCEEW	June to July or November to December	Winter-wet clay flats.
Levenhookia preissii	P1	DBCA	September to December or January	Swamps with grey or black, peaty sand.
Macarthuria keigheryi	T	Biota, DBCA, DCCEEW, Strategen, WEC	September to December	White or grey sand. Flats, plains.
Morelotia australiensis	T	DBCA, WEC	September to December	Flats and winter damp areas, on grey sand over clay, sandy clays.
Myriophyllum echinatum	P3	DBCA, WEC	September to November	Clay. Winter-wet flats.
Ornduffia submersa	P4	DBCA	September to October	Black-grey sandy clay in seasonally inundated wetlands.
Platysace ramosissima	P3	Biota, DBCA	November to February	Sandy clay soils, usually on flats or plains, often near wetlands.

Taxon	Status (WA)	Source	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)
Poranthera moorokatta	P2	DBCA, WEC	September to October	Slope and plains with white or grey sand, typically in Banksia woodlands.
Ptilotus pyramidatus	T	DBCA, DCCEEW	October to December	Wetland edges and inundated flats with grey/white sandy clay.
Schoenus benthamii	P3	DBCA, WEC	October to November	Winter-wet flats and swamps with sand and sandy clay.
Schoenus capillifolius	P3	DBCA	October to November	Brown clay or sandy clay. Winter-wet claypans and flats.
Schoenus natans	P4	DBCA	September to December	Brown or grey sandy clay. Growing in shallow water in creeklines, claypans and wetlands.
Schoenus pennisetis	P3	DBCA	August to September	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	DBCA	October to November	Brown or grey clay or sandy clay. Winter-wet flats and wetlands.
Stylidium aceratum	P3	DBCA, WEC	October to November	Grey or brown sandy loam or clay. Wetlands, swamps and winter-wet flats.
Stylidium longitubum	P4	DBCA, WEC	October to December	Claypans, sometimes slightly saline.
Styphelia filifolia	P3	DBCA, WEC	February to April	Sand. Sandplains, slopes and flats.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	DBCA, DCCEEW	September to October	Winter-wet clay flats, sometimes with laterite gravel.
Synaphea sp. Pinjarra Plain (A.S. George 17182)	T	DCCEEW	September to November	Flats and seasonally wet areas, often with wet depressions on grey/brown sandy loam or clay loam, often with, laterite.
Thelymitra dedmaniarum	T	DCCEEW	November to December	Granite outcrops on slopes.
Thelymitra magnifica	T	DBCA	October to November	Slopes and gullies with laterite or granite.
Thelymitra stellata	T	DBCA, DCCEEW	October to November	Lateritic soils on hill tops and breakaways.
Thysanotus anceps	P3	DBCA	November to January	Sand or sandy loam with laterite. Ridges, hilltops and slopes.
Verticordia lindleyi subsp. *lindleyi*	P4	Biota, DBCA, Strategen, WEC	May or November to January	Winter-wet depressions.

Sources are: Biota – Biota (2003), DBCA – DBCA (2023b), DCCEEW – DCCEEW (2023), Strategen – Strategen (2018), WEC – Woodman Environmental (2020, 2021).

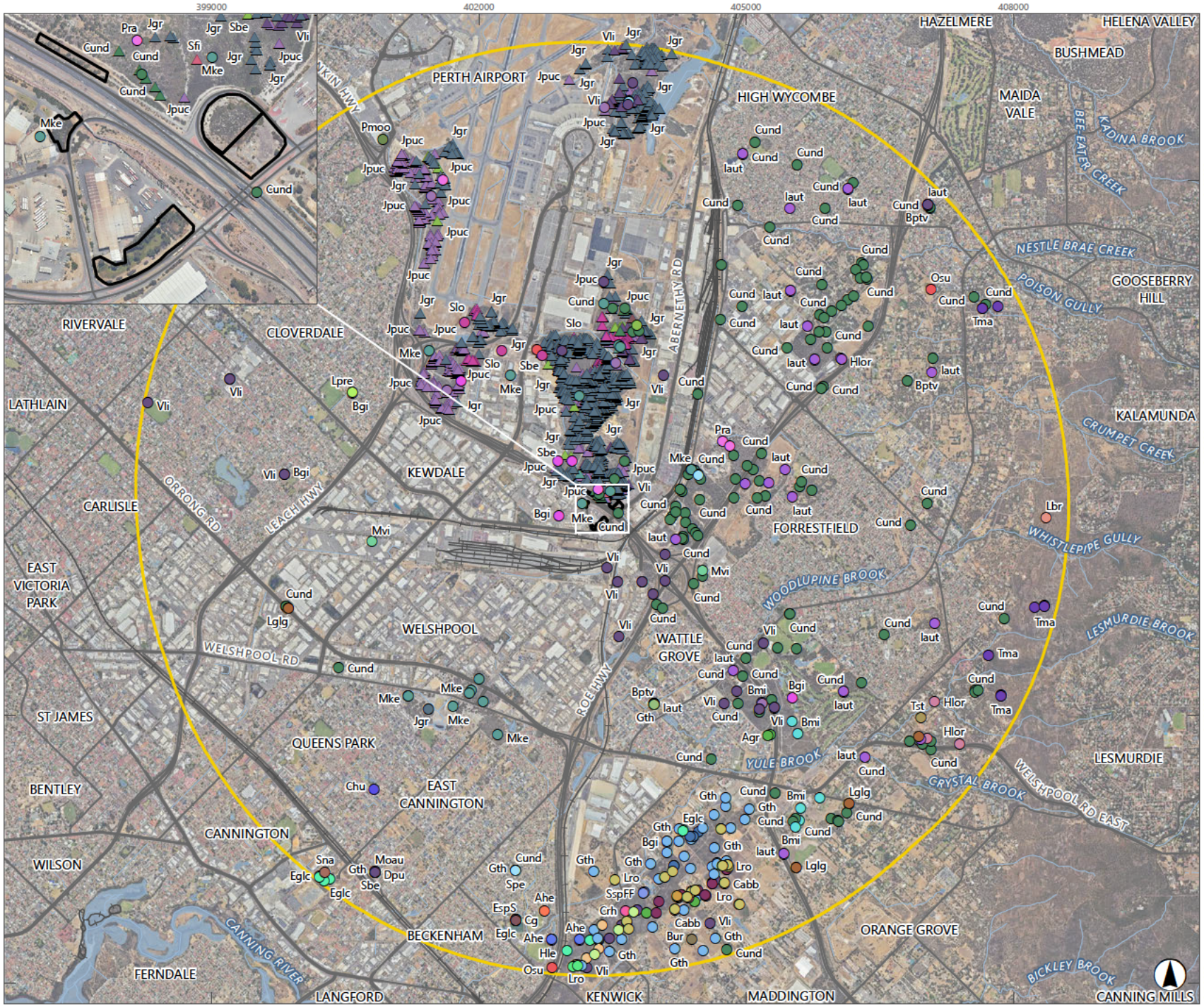


FIGURE 5.1

Significant Flora Taxa within the Desktop Study Area

Legend

- Desktop Study Area
- Study Area
- Railway
- Road
- Watercourse
- Waterbody

Scale: 1:60,000 at A4
GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023c), Woodman Environmental (2020)

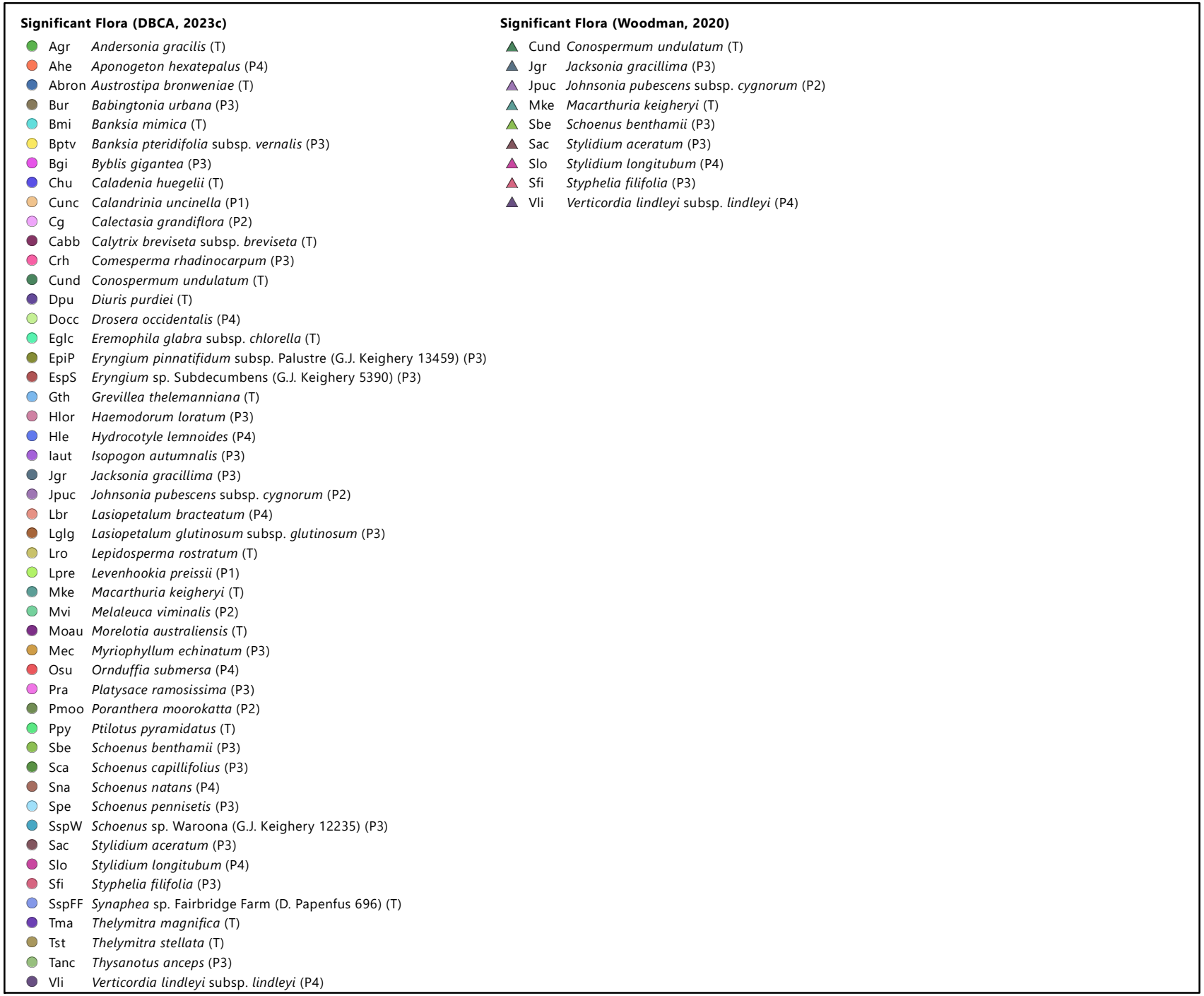


FIGURE 5.1

LEGEND: Significant Flora Taxa within the Desktop Study Area

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023c), Woodman Environmental (2020)

5.1.4 Significant Vegetation

The interrogation of the DBCA TEC and PEC Database (DBCA, 2023a) and DCCEEW's SPRAT Database (DCCEEW, 2023) returned a total of 17 significant communities that have records in the Desktop Study Area as presented in **Table 5.4**. Three of these communities form part of the 'Banksia woodlands of the Swan Coastal Plain' TEC and three of these communities form part of the 'Clay Pans of the Swan Coastal Plain' TEC (**Table 5.4**).

Definitions, categories and criteria for TECs and PECs are presented on the DBCA Threatened Species and Communities website (DBCA, 2023d).

Table 5.4 Significant Vegetation Known from Within the Desktop Study Area

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered (EPBC)	P3	Canopy is most commonly dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*. Other Banksia species that can dominate in the community are *B. prionotes* or *B. ilicifolia*. It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands; it is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau and, in other less common scenarios. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community.	DBCA DCCEEW (likely to occur within area) Strategen WEC
SCP20a – *Banksia attenuata* woodland over species rich dense shrublands	Commonly a component of the 'Banksia Woodlands of the Swan Coastal Plain ecological community' (Endangered)	Critically Endangered	Occurs on sands at the base of the Darling Scarp between Chittering and Gosnells, and are the richest of any Banksia community found on the SCP (average 67 species per 100 m2). It is usually dominated by *Banksia attenuata* (occasionally with *Eucalyptus marginata*) with *Bossiaea eriocarpa*, *Conostephium pendulum*, *Hibbertia striata*, *Hibbertia hypericoides*, *Petrophile linearis*, *Scaevola repens*, *Stirlingia latifolia*, *Mesomelaena pseudostygia* and *Alexgeorgea nitens* being common in the understorey. Structurally, this group is either *Banksia attenuata* woodlands or *Eucalyptus marginata - Banksia attenuata* woodlands, and is distinctive in having a diverse shrub layer and faithful *Mesomelaena pseudostygia*.	DBCA Strategen WEC
SCP20b – *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	Commonly a component of the 'Banksia Woodlands of the Swan Coastal Plain ecological community' (Endangered)	Endangered	The community is found on a range of soil and landform units at the base of the Darling Scarp. The community occurs largely on the Forrestfield unit (Ridge Hill Shelf), Guildford unit or at the confluence of Guildford with Forrestfield, but also occurs on the Southern River unit. The community is generally very species rich. Most occurrences of this community type are *Eucalyptus marginata – Banksia attenuata* woodlands but Banksia woodlands and heaths are also found, with *Mesomelaena pseudostygia*, *Morelotia octandra*, *Banksia dallanneyi* (couch honeypot), *Desmocladus fasciculatus*, and *Chamaescilla corymbosa* (blue squill) being common in the understorey.	DBCA

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands	Commonly a component of the 'Banksia Woodlands of the Swan Coastal Plain ecological community' (Endangered)	P3	This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regelia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland.	DBCA Strategen
Clay Pans of the Swan Coastal Plain	Critically Endangered	-	The clay pan communities occur where clay substrate is low in the landscape and forms an impermeable layer close to the surface. These wetlands that rely on rainfall and local surface drainage to fill are considered unlikely to be connected to groundwater. The clay pans then dry out to form a relatively impervious substrate in summer. A suite of perennial plants that propagate by underground bulbs, tubers or corms (geophytes), and annual herbs flower sequentially as the clay pans dry out. The clay pans are the most diverse of the SCP wetlands and contain a number of local endemic flora.	DCCEEW (likely to occur within area)
SCP07 – Herb rich saline shrublands in clay pans	Component of 'Clay Pans of the Swan Coastal Plain' (Critically endangered)	Vulnerable	The community is generally dominated by *Melaleuca viminea* (mohan), *Melaleuca osullivanii*, *Melaleuca cuticularis* (saltwater paperbark) or *Casuarina obesa* (swamp sheoak) or a mixture of these species. It has been recorded between Mogumber and Ambergate on heavy clay soils that are generally inundated from winter to mid-summer. The species *Melaleuca cuticularis* and *Casuarina obesa* may indicate some saline influence for at least part of the year. Herbs such as *Brachyscome bellidioides*, *Centrolepis polygyna* (wiry centrolepis), *Pogonolepis stricta* (stiff angianthus) and *Cotula coronopifolia* (waterbuttons; note: listed as alien on Florabase) are typical of this community. In addition, species such as *Angianthus drummondii* (P3), *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459) (P3) and *Blennospora drummondii* occur in the community at low frequency. A suite of annual flora is seen in the community as the season progresses. In early spring many of the occurrences of the community are covered by free water up to 30 cm deep. *Cotula coronopifolia* sometimes forms yellow floating mats in some pools while others may be dominated by *Ornduffia submersa* (P4). Aquatic species are common in the community early in the growing season. As the wetland dries a succession of species such as *Centrolepis* spp. and annual *Stylidium* spp. successively germinate, grow and flower, resulting in an extended flowering period of over three months.	DBCA

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
SCP08 – Herb rich shrublands in clay pans	Component of 'Clay Pans of the Swan Coastal Plain' (Critically endangered)	Vulnerable	The community has been recorded between Bullsbrook and Ludlow and occurs in low-lying flats with a clay impeding layer that facilitates seasonal inundation. The vegetation can be dominated by *Viminaria juncea* (swishbush), *Melaleuca viminea* (mohan), *Melaleuca lateritia* (robin redbreast bush) or *Melaleuca osullivanii* (broombush) but also occasionally by *Eucalyptus wandoo* (wandoo). Commonly occurring flora include *Hypocalymma angustifolium* (white myrtle), *Acacia lasiocarpa* var. *bracteolata* (long peduncle form) and *Verticordia huegelii* (variegated featherflower), and aquatic annuals.	DBCA
SCP10a – Shrublands on dry clay flats	Component of 'Clay Pans of the Swan Coastal Plain' (Critically endangered)	Endangered	The community occurs on clay flats with thin skeletal soils and has been recorded largely between Wattle Grove and Sabina River. It comprises rapidly drying clay flats. Typical and common shrubs include *Hakea sulcata* (furrowed hakea), *Verticordia densiflora* (compacted featherflower), *Hakea varia* (variable-leaved hakea), *Pericalymma ellipticum* (swamp teatree) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia), *Centrolepis aristata* (pointed centrolepis), *Drosera gigantea* (giant sundew) and *Drosera menziesii* (pink rainbow) also commonly occur.	DBCA
SCP20c – Shrublands and Woodlands of the eastern Swan Coastal Plain (Endangered)	Endangered	Critically Endangered	The community occurs mainly on the transitional soils of the Ridge Hill Shelf, on the SCP adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the SCP. It has been recorded between Stratton and Maddington. It generally comprises a shrubland or woodland of *Banksia attenuata* (slender banksia) and *Banksia menziesii* (firewood banksia), sometimes with *Allocasuarina fraseriana* (western sheoak), over a shrub layer that can include the species *Adenanthos cygnorum* (woollybush), *Hibbertia huegelii*, *Scaevola repens* var. *repens* (fan flower), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Hibbertia hypericoides* (yellow buttercups) and *Stirlingia latifolia* (blueboy). A suite of herbs including *Conostylis aurea* (golden conostylis), *Trachymene pilosa* (native parsnip), *Lomandra hermaphrodita, Burchardia congesta* (milkmaids) and *Patersonia occidentalis* (purple flag), and the sedges *Mesomelaena pseudostygia* (semaphore sedge) and *Lyginia barbata* usually occur in the community.	DBCA WEC
SCP3a – *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan	Endangered	Critically Endangered	The community has been recorded from heavy soils of the eastern side of the southern SCP largely between Capel and Chittering. Typical native taxa in the community are the tree *Corymbia calophylla* (marri), the shrubs *Banksia dallanneyi* (couch honeypot), *Philotheca spicata* (pepper and salt), *Kingia australis* (kingia) and *Xanthorrhoea preissii* (balga), and the herbs, rushes and sedges *Cyathochaeta avenacea*, *Dampiera linearis* (common dampiera), *Haemodorum laxum*, *Desmocladus fasciculatus*, *Mesomelaena tetragona* (semaphore sedge) and *Morelotia octandra*.	DBCA DCCEEW (known to occur within area) WEC

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
SCP3b – *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain	-	Endangered	The community is known from the eastern side of the SCP largely between Wannamal and Dunsborough. Most occurrences of the community are dominated by both *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) with additional common taxa comprising low shrubs, sedges, grasses and herbs. These include *Bossiaea eriocarpa* (common brown pea), *Conostylis juncea*, *Hibbertia hypericoides* (yellow buttercups), *Morelotia octandra*, *Chamaescilla corymbosa* (blue squill), *Desmocladus fasciculatus*, *Banksia dallanneyi* (couch honeypot), *Mesomelaena tetragona* (semaphore sedge), *Babingtonia camphorosmae* (camphor myrtle), *Lepidosperma squamatum*, *Neurachne alopecuroidea* (foxtail mulga grass), *Philotheca spicata* (pepper and salt), *Burchardia congesta* (milkmaids), *Caesia micrantha* (pale grass-lily), *Kingia australis* (kingia), *Drosera erythrorhiza* (red ink sundew), *Lomandra hermaphrodita* and *Caladenia flava* (cowslip orchid).	DBCA WEC
SCP3c – *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	Endangered	Endangered	The community occurs on heavy soils of the eastern side of the southern SCP, generally between Bullsbrook and Stratham. The community is usually dominated by *Corymbia calophylla* (marri) and *Xanthorrhoea preissii* (balga). It also occasionally includes *Eucalyptus wandoo* (wandoo). The more common shrubs include *Gompholobium marginatum*, *Hypocalymma angustifolium* (white myrtle) and *Banksia dallanneyi* (couch honeypot), with herbs, grasses and sedges including *Burchardia congesta* (milkmaids), *Cyathochaeta avenacea*, *Neurachne alopecuroidea* (foxtail mulga grass), *Caesia micrantha* (pale grass-lily), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra*, *Desmocladus flexuosus, Opercularia vaginata* (dog weed), *Sowerbaea laxiflora* (purple tassels), *Lepidosperma* spp. and *Drosera menziesii* (pink rainbow) also common.	DBCA WEC
SCP15 – Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	-	Vulnerable	The community has been recorded from Bambun to Nirimba, on alluvial sediments on sites that are inundated for long periods resulting in more typical aquatic and flora of deeper wetlands. The community is generally dominated by *Melaleuca rhaphiophylla* (swamp paperbark) or *Casuarina obesa* (swamp sheoak). Other species can include *Melaleuca teretifolia* (banbar), *Atriplex cinerea* (grey saltbush), *Samolus repens* (creeping brookweed), *Salicornia quinqueflora* (beaded samphire) and *Sporobolus virginicus (*marine couch).	WEC

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
SCP02 – Southern wet shrublands, Swan Coastal Plain	-	Critically Endangered	The community typically comprises shrublands or open woodlands. It occurs on seasonally inundated sandy clay soils that are restricted to small remnants on the eastern side of the SCP. It has been recorded from Forrestfield to Chapman Hill. The community has moderate species richness with the occurrence of species reflecting the wetter nature of the sites. Typical and common native taxa in the community are the shrubs *Kingia australis* (kingia), *Pericalymma ellipticum* (swamp teatree), *Hakea ceratophylla* (horned leaf hakea), *Calothamnus lateralis*, *Hypocalymma angustifolium* (white myrtle), *Eutaxia virgata*, *Stirlingia latifolia* (blueboy), *Banksia dallanneyi* (couch honeypot) and herbs, rushes and sedges including *Dampiera linearis* (common dampiera), *Comesperma virgatum* (milkwort), *Stylidium brunonianum* (pink fountain triggerplant), *Thysanotus multiflorus* (many-flowered fringe lily) and *Mesomelaena tetragona* (semaphore sedge). The community also contains priority flora including *Isopogon formosus* subsp. *dasylepis* (P3) and *Grevillea brachystylis* subsp. *brachystylis* (P3).	DBCA
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	Endangered	The community occurs on the heavy soils of the eastern side of the SCP and has been recorded between Beermullah and Wokalup. Known patches include wetland and well-drained habitats, in a variety of landforms. It is defined on the basis of substrates with a limestone influence. Many of the species are commonly associated with the limestone soils that occur on the coast, and do not generally occur further inland. Typical and common native species in areas of best developed limestone are: the tree *Casuarina obesa* (swamp sheoak); the mallees *Eucalyptus decipiens* (redheart) and *Eucalyptus foecunda* (narrow-leaved red mallee); the shrubs *Melaleuca huegelii* (chenille honey-myrtle), *Alyogyne huegelii* (lilac hibiscus), *Grevillea curviloba* (T), *Grevillea evanescens* (P1) and *Melaleuca systena* (coastal honeymyrtle); and the herb *Thysanotus arenarius* (sand-dune fringed lily). Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as clay content, with the presence of calcicoles such as *Thysanotus arenarius, Gahnia trifida* (coast saw-sedge), *Eremophila glabra* (tar bush) and *Melaleuca brevifolia* (mallee honey-myrtle) providing evidence of the limestone influence. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands and *Melaleuca brevifolia*, *Melaleuca systena* or *Melaleuca viminea* shrublands have been recorded on Muchea Limestone.	DBCA

Community	Status (EPBC)#	Status (WA)#	Description^	Source*
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community: TEC	Critically Endangered	P3	Mostly confined to Quindalup Dunes and Spearwood Dunes but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands. Tuart is the key upper canopy species although it may co-occur with trees of other species. Trees commonly co-occurring with Tuart include *Agonis flexuosa*, *Banksia grandis*, *Banksia attenuata*, *Eucalyptus marginata*; and less commonly, *Corymbia calophylla*, *Banksia menziesii* and *Banksia prionotes*. An understorey of native plants is typically present, which may include grasses, herbs and shrubs. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community.	DCCEEW: Community may occur within area
Central Northern Darling Scarp Granite Shrubland Community	-	P4	Shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs *Xanthorrhoea acanthostachya* and *Allocasuarina humilis* over smaller proteaceous and myrtaceous shrubs, namely *Melaleuca* aff. *scabra*, *Baeckea camphorosmae* and to a lesser extent, the proteaceous shrubs *Dryandra armata*, *Hakea incrassata* and *Hakea undulata*. Located in central region of the Northern Darling Scarp near Perth.	DBCA

#TECs are listed under the EPBC Act, and/or under the BC Act, as Critically Endangered, Endangered or Vulnerable. PECs are classified into Priority (P) categories in WA by DBCA.

^Sources are: DBCA PEC list for PEC descriptions (DBCA, 2023e), DBCA (then DPAW (2016)) for FCT 20a, Meissner & English (2005) for Perth to Gingin Ironstone Association, DBCA (then DPAW) (2015) for Clay Pans of the Swan Coastal Plain.

**Data sources are: DBCA – DBCA (2023b), DCCEEW – DCCEEW (2023), Strategen – Strategen (2018), WEC – Woodman Environmental (2020, 2021).*

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023b)

Significant Vegetation (DBCA 2023b)

Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community (WA - P3; EPBC - EN)
Central Granite Shrublands	Central Northern Darling Scarp Granite Shrubland Community (Com 5, Markey) (WA - P4)
Muchea Limestone	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain (WA - EN; EPBC - EN)
SCP02	Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson et al. (1994)) (WA - EN)
SCP3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in Gibson et al. (1994)) (WA - CE; EPBC - EN)
SCP3b	*Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community type 3b as originally described in Gibson et al. (1994)) (WA - VU)
SCP3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in in Gibson et al. (1994)) (WA - CE; EPBC - EN)
SCP07	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. (1994)) (WA - VU; EPBC - CE)
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994)) (WA - VU; EPBC - CE)
SCP10a	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994)) (WA - EN; EPBC - CE)
SCP20a	*Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994)) (WA - EN; EPBC - EN)
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. (1994)) (WA - EN; EPBC - EN)
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20c as originally described in in Gibson et al. (1994)) (WA - CE; EPBC - EN)
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands (WA - P3; EPBC - EN)

FIGURE 5.2

LEGEND: DBCA Significant Vegetation Records from the Desktop Study Area

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023b)

5.2 Field Survey

5.2.1 Vascular Flora Census

A total of 73 discrete vascular flora taxa were recorded in the Study Area by the survey, representing 28 families and 61 genera. Of these, 16 taxa are introduced (see **Section 5.2.4**). The most well represented families were Myrtaceae (16 taxa), Fabaceae, Proteaceae and Poaceae (all 7 taxa).

A full list of taxa recorded by the survey is presented in **Appendix B**, with raw relevé data and parameters presented in **Appendix C**.

5.2.2 Significant Flora

No listed significant flora (excluding planted occurrences of *Grevillea thelemanniana* (T) discussed below) were recorded during the field survey of the Study Area. No other taxa recorded in the Study Area are considered to represent significant flora for any other reason (as per EPA (2016a)).

Grevillea thelemanniana is a listed Threatened taxon, which is only known from the Brixton Street Wetlands in the Kenwick area (TSSC, 2017). This species is typically found in winter-wet low-lying flats (WA Herbarium, 1998-), whereas individuals recorded by Umwelt within the Study Area were recorded in dry habitats in revegetated areas adjacent to the Tonkin Highway on/off-ramps. All recorded individuals of this taxon were deemed to be planted and are considered not naturally present in the Study Area; therefore, they have not been considered significant and are not discussed further in this report in the context of significant flora.

5.2.3 Likelihood of Occurrence of Further Significant Flora Taxa

Table 5.5 presents an assessment of the likelihood of occurrence of significant taxa within the Study Area. This list includes significant taxa identified as occurring (or potentially occurring) within the Desktop Study Area prior to survey (listed in **Table 5.3**). This assessment considered whether a taxon was identifiable at the time of survey, the known range of the taxon, if habitat is present in the Study Area, proximity of known records to the Study Area, and the extent of targeted survey undertaken within the Study Area, when determining the potential for a taxon to occur in the Study Area.

A total of 66 significant flora taxa have been assessed within **Table 5.5** including 34 Threatened taxa, and 32 Priority listed taxa. Given this was an out of season survey, 23 of these taxa were likely unidentifiable at the time of survey. It is considered that the 43 remaining taxa were identifiable during the survey, either because the survey period coincides with the taxon's flowering period, or the taxon can be identified reliably when in fruit or sterile.

As discussed in **Section 5.2.2**, no significant flora taxa were recorded within the Study Area by the survey, with the exception of *Grevillea thelemanniana* (T) which was planted in the road verge and is therefore not considered to be a natural population.

The majority of the Study Area was not considered to be suitable habitat for significant flora taxa due to the high level of disturbance and prior clearing which has been undertaken in the Study Area. The only area that represents remnant vegetation and provides potential habitat for (some) significant flora taxa is the area mapped as VT 1 (see **Section 5.2.5**, **Figure 5.3**). As discussed in **Section 3.3.3**, the entire area of VT 1 was gridded for significant flora taxa (those that were identifiable at the time of survey) at 10 m spacings (see **Figure 3.1**).

All significant flora taxa that were identifiable at the time of the survey are considered unlikely to occur in the Study Area, either because they were adequately surveyed for during the survey and/or there is no suitable habitat within the Study Area. Of the 23 taxa which were not considered to be identifiable at the time of survey, 22 were considered unlikely to occur in the Study Area due to potential habitat not being present, with the Study Area also being outside the known distribution of some taxa (as listed in **Table 5.5**). The likelihood of occurrence assessment identified one taxon that was not identifiable at the time of survey, which could potentially occur within the Study Area (due to suitable habitat occurring within the Study Area and the Study Area being within the known range of the taxon or within close proximity to its known range), being *Poranthera moorokatta* (P2).

Poranthera moorokatta (P2) is a small annual herb which was formally described in 2012, and has historically been previously been confused with smaller plants of the common *Poranthera microphylla* (Barrett, 2012). Therefore, this taxon was not recognised as a discrete taxon at the time of the previous survey over the Study Area by Biota (2003). However, Biota recorded *Poranthera microphylla* at a single location in quadrat AR05 which is located at the edge of the embankment area, with the majority of this quadrat likely cleared during construction of the Tonkin highway on-ramp. *Poranthera microphylla* was not recorded at any other quadrats assessed by Biota in the Study Area. Based on this, there is a further reduced likelihood that *Poranthera moorokatta* (P2) occurs within the Study Area. If additional locations of *Poranthera microphylla* were recorded by Biota (2003), this would increase the confidence that *Poranthera moorokatta* (P2) may be present in the Study Area, as such locations could be surveyed (in the appropriate season) to confirm if the locations were actually occurrences of *Poranthera moorokatta* (P2). Given the lack of extant occurrences of *Poranthera microphylla* in the Study Area, in conjunction with the condition of the vegetation in the Study Area, *Poranthera moorokatta* (P2) is considered relatively unlikely to occur in the Study Area (when considering previous data from the Study Area). However, as it was unidentifiable at the time of this current survey, it cannot be ruled out entirely and it is therefore considered 'possible to occur' in the Study Area (**Table 5.5**).

Table 5.5 Likelihood of Occurrence of Significant Flora Taxa in the Study Area

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Acacia anomala	T	August to September	Lateritic soils on hill slopes.	Yes	5.2 km NE of Study Area	Unlikely: habitat not considered to be present
Acacia aphylla	T	August to October	Granite outcrops and hills on sand, loam or clay loam.	Yes	7.3 km NE of Study Area	Unlikely: habitat not considered to be present
Andersonia gracilis	T	October to November	Winter-wet sandy clay flats and depressions.	Yes	3 km SE of Study Area	Unlikely: habitat not considered to be present
Anigozanthos viridis subsp. *terraspectans*	T	August to October	Winter-wet clay flats and depressions.	Yes	> 90 km NW of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Anthocercis gracilis	T	September to October	Granite outcrops on sandy or loamy soils.	Yes	7.5 km SE of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Aponogeton hexatepalus	P4	February, May to November	Brown, grey or black clay. Growing in shallow water in major drainage lines and wetlands, claypans.	Yes	4.3 km S of Study Area	Unlikely: habitat not considered to be present
Austrostipa bronweniae	T	April or October	Seasonally inundated damplands and wetlands with sandy clay or loam.	No	3.6 km S of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Babingtonia urbana	P3	December to March	Brown clay loam and sand. Winter-wet flats and wetlands.	Yes	4.7 km S of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Banksia mimica	T	December, January to February	Flats and lowerslopes on white or grey sand over laterite, sandy loam.	Yes	2.7 km SE of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Banksia pteridifolia subsp. *vernalis*	P3	September to October	White/grey sand over laterite, usually on plains or lower slopes.	Yes	2.1 km SSE of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Byblis gigantea	P3	September to January	Sandy-peat swamps. Seasonally wet areas.	Yes	0.3 km W of Study Area	Unlikely: habitat not considered to be present

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Caladenia huegelii	T	September to October	Jarrah/Banksia woodland on flats and lowerslopes with deep grey white sand.	No	3.8 km SW of Study Area	Unlikely: habitat not considered to be present
Calandrinia uncinella	P1	September to October	Seasonally wet flats and wetlands with silty loam or clay.	No	4.5 km S of Study Area	Unlikely: habitat not considered to be present
Calectasia grandiflora	P2	June to November	Swamps, wetlands and seasonally moist flats with sandy clay.	Yes	4.5 km S of Study Area	Unlikely: habitat not considered to be present
Calytrix breviseta subsp. *breviseta*	T	October to November	Winter wet clay flats and depressions.	Yes	4.1 km SSE of Study Area	Unlikely: habitat not considered to be present
Chamelaucium lullfitzii	T	September to December	Usually orange-yellow sand (occasionally grey), sometimes with gravel, on hill slopes.	Yes	> 50 km N of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Comesperma rhadinocarpum	P3	October to January	Sand or sandy loam with laterite. Slopes, undulating plains and flats.	Yes	4.3 km S of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Conospermum undulatum	T	May to October	Sand and sandy clay soils, often over laterite, on flat or gently slopes.	Yes	0.1 km E of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Darwinia apiculata	T	October	Flats and hills with laterite or granite on sandy loam or clay.	Yes	5.5 km E of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Diplolaena andrewsii	T	August to October	Granite outcrops on hill slopes.	Yes	13 km NE of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Diuris drummondii	T	November to January	Swamps, often in shallow water.	No	8.5 km N of Study Area	Unlikely: habitat not considered to be present

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Diuris micrantha	T	September to October	Swamps, often in shallow water.	No	30 km S of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Diuris purdiei	T	September to October (only after fire)	Swampy flats.	No	4.3 km S of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Drakaea elastica	T	October to November	Grey sand flats adjacent to swamps.	No	26 km SW of Study Area	Unlikely: habitat not considered to be present
Drakaea micrantha	T	September to October	Grey sand flats adjacent to swamps.	No	11.8 km SW of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Drosera occidentalis	P4	October to November	Swampy or damp flats, sandy floodplain.	No	4.3 km S of Study Area	Unlikely: habitat not considered to be present
Eleocharis keigheryi	T	August to November	Swamps, in fresh water.	Yes	5.4 km S of Study Area	Unlikely: habitat not considered to be present
Eremophila glabra subsp. *chlorella*	T	July to November	Winter wet clay flats and depressions.	Yes	3.5 km SSE of Study Area	Unlikely: habitat not considered to be present
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3	September to November	Grey, brown or black sand or clay. Winter-wet flats and claypans.	Yes	4.5 km SSW of Study Area	Unlikely: habitat not considered to be present
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	September to January	Grey clay. Winter-wet flats, claypans and swamps.	Yes	4.5 km SSW of Study Area	Unlikely: habitat not considered to be present
Eucalyptus x balanites	T	October to December or January to February	Hills and plains with sand and sandy loam, often with laterite.	Yes	22 km S of Study Area	Unlikely: habitat not considered to be present

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Goodenia arthrotricha	T	October to November	Granite rocks and slopes.	Yes	10.6 km SE of Study Area	Unlikely: habitat not considered to be present
Grevillea curviloba	T	August to September	Sand, sandy loam. Winter-wet flats.	Yes	35 km S of Study Area	Unlikely: habitat not considered to be present
Grevillea flexuosa	T	July to October	Breakaways and slopes with laterite.	Yes	21 km NE of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Grevillea thelemanniana	T	October to November	Slopes and crests with granite or laterite on gravel and brown sandy loam or clay.	Yes	2.1 km SSE of Study Area	Present - planted individuals only, natural populations of this taxon are only known from Brixton Street Wetlands (see **Section 5.2.2**)
Haemodorum loratum	P3	November	Grey or yellow sand, gravel. Plains, lower slopes.	Yes	4.2 km SE of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Hydrocotyle lemnoides	P4	August to October	Swamps, winter wet clay pans.	No	4.5 SSE of Study Area	Unlikely: habitat not considered to be present
Isopogon autumnalis	P3	February to June	Grey or yellow sand, sometimes with laterite gravel. Plains, flats, lower slopes.	Yes	0.7 km SE of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Jacksonia gracillima	P3	October to November	Sandy flats and in wetlands.	Yes	2.7 SW of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Johnsonia pubescens subsp. *cygnorum*	P2	September	Flats, seasonally-wet sites with grey-white-yellow sand.	Yes	1.4 km N of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Lasiopetalum bracteatum	P4	September to February	Brown or yellow clayey sand, sometimes over granite. Hilltops, slopes and drainage lines.	Yes	2.1 km S of Study Area	Unlikely: habitat not considered to be present
Lasiopetalum glutinosum subsp. *glutinosum*	P3	September to December	Sandy loam or clay with granite. Granite outcrops and slopes.	Yes	3.6 km SW of Study Area	Unlikely: habitat not considered to be present

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Lepidosperma rostratum	T	June to July or November to December	Winter-wet clay flats.	Yes	3.7 km S of Study Area	Unlikely: habitat not considered to be present
Levenhookia preissii	P1	September to December or January	Swamps with grey or black, peaty sand.	No	2.8 km WSW of Study Area	Unlikely: habitat not considered to be present
Macarthuria keigheryi	T	September to December	White or grey sand. Flats, plains.	Yes	0.1 km N of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Morelotia australiensis	T	September to December	Flats and winter damp areas, on grey sand over clay, sandy clays.	Yes	4.5 km SW of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Myriophyllum echinatum	P3	September to November	Clay. Winter-wet flats.	No	4.3 SSW of Study Area	Unlikely: habitat not considered to be present
Ornduffia submersa	P4	September to October	Black-grey sandy clay in seasonally inundated wetlands.	No	1.6 km NNW of Study Area	Unlikely: habitat not considered to be present
Platysace ramosissima	P3	November to February	Sandy clay soils, usually on flats or plains, often near wetlands.	Yes	0.1 km N of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Poranthera moorokatta	P2	September to October	Flats, damplands and plains on grey/white sand.	No	4.5 km NW of Study Area	**Possible: potential habitat present in the Study Area**
Ptilotus pyramidatus	T	October to December	Wetland edges and inundated flats with grey/white sandy clay.	Yes	4.9 km S of Study Area	Unlikely: habitat not considered to be present
Schoenus benthamii	P3	October to November	Winter-wet flats and swamps with sand and sandy clay.	Yes	1.9 km N of Study Area	Unlikely: habitat not considered to be present
Schoenus capillifolius	P3	October to November	Brown clay or sandy clay. Winter-wet claypans and flats.	No	4.9 SSW of Study Area	Unlikely: habitat not considered to be present

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Schoenus natans	P4	September to December	Brown or grey sandy clay. Growing in shallow water in creeklines, claypans and wetlands.	No	4.9 SW of Study Area	Unlikely: habitat not considered to be present
Schoenus pennisetis	P3	August to September	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	No	0.9 NE of Study Area	Unlikely: habitat not considered to be present
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	October to November	Brown or grey clay or sandy clay. Winter-wet flats and wetlands.	No	4.5 km SSW of Study Area	Unlikely: habitat not considered to be present
Stylidium aceratum	P3	October to November	Grey or brown sandy loam or clay. Wetlands, swamps and winter-wet flats.	No	4.5 km SSW of Study Area	Unlikely: habitat not considered to be present
Stylidium longitubum	P4	October to December	Claypans, sometimes slightly saline.	No	1.5 km NW of Study Area	Unlikely: habitat not considered to be present
Styphelia filifolia	P3	February to April	Sand. Sandplains, slopes and flats.	Yes	2.7 km SE of Study Area	Unlikely: all potential habitat present in the Study Area grid searched at 10 m spacing
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	September to October	Winter-wet clay flats, sometimes with laterite gravel.	Yes	4.1 km S of Study Area	Unlikely: habitat not considered to be present
Synaphea sp. Pinjarra Plain (A.S. George 17182)	T	September to November	Flats and seasonally wet areas, often with wet depressions on grey/brown sandy loam or clay loam, often with, laterite.	Yes	32 km S of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Thelymitra dedmaniarum	T	November to December	Granite outcrops on slopes.	No	19.8 km NE of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon
Thelymitra magnifica	T	October to November	Slopes and gullies with laterite or granite.	No	4.4 km ESE of Study Area	Unlikely: habitat not considered to be present, the Study Area is outside of the known distribution of this taxon

Taxon	Status (WA)	Flowering Period (WA Herbarium, 1998-)	Habitat (WA Herbarium, 1998-)	Identifiable During Survey?	Nearest DBCA record to Study Area	Likelihood of Occurrence in Study Area
Thelymitra stellata	T	October to November	Lateritic soils on hill tops and breakaways.	No	4.1 km SE of Study Area	Unlikely: habitat not considered to be present
Thysanotus anceps	P3	November to January	Sand or sandy loam with laterite. Ridges, hilltops and slopes.	Yes	2.1 km SSE of Study Area	Unlikely: habitat not considered to be present
Verticordia lindleyi subsp. *lindleyi*	P4	May or November to January	Winter-wet depressions.	Yes	0.5 km S of Study Area	Unlikely: habitat not considered to be present

5.2.4 Introduced Taxa

A total of 16 introduced flora taxa were recorded within the Study Area by the current survey. These taxa are listed in **Table 5.6**, with locations presented in **Appendix D** and on **Figure 5.4**. It should be noted that this does not represent a comprehensive survey of all introduced flora locations in the Study Area, as this was beyond the scope of this survey. In addition, as this survey was undertaken out of season, it is likely that more introduced taxa would be present in the Study Area in spring.

The significance of the recorded introduced flora taxa, with reference to the ecological impact and invasiveness ratings for each introduced taxon as per 'Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife for the Swan Region' (DBCA, 2016) is also presented in **Table 5.6**.

One of the recorded introduced flora taxa is a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and a Weed of National Significance (WoNS) (Weeds Australia, 2023), being *Opuntia stricta* (Common Prickly Pear), with the status of this taxon rated as s22(2) (C3 Restricted) (DPIRD, 2023). *Opuntia stricta* was recorded as a single plant at one location in the area adjacent to the Tonkin Highway off-ramp; this area consisted of planted trees and shrubs adjacent to a cleared area (**Figure 5.4**). Several other taxa considered to be serious weeds were also recorded in the Study Area as discussed below.

Eragrostis curvula (African Lovegrass) is a widespread and serious weed of road verges and disturbed ground from Carnarvon to the Nullarbor, and is highly invasive (DBCA, 2016; Hussey et al., 2007). This taxon was recorded within two blocks within the Study Area (**Figure 5.4**).

Ehrharta calycina (Perennial Veldt Grass) is known to be a significant weed, occurring extensively within roadsides and bushland on sandy soils from Geraldton to Esperance, and is particularly common on the SCP, where it is one of the most serious bushland weeds and a significant fire hazard (Hussey et al., 2007). *Ehrharta calycina* was present throughout the Study Area including within VT 1. Locations of this taxon are presented on **Figure 5.4**; however, this does not display the full extent of the distribution of this taxon within the Study Area (as noted above).

Leptospermum laevigatum (Coast Teatree) is a major bushland weed, spreading rapidly along road verges from Jurien to Esperance and often invading coastal heath and woodlands on sandy and lateritic soils (Hussey et al., 2007). This taxon was present within VT 1, as well as at least two other locations within the Study Area.

Thirteen introduced taxa recorded in the Study Area by the survey are rated as having 'High' ecological impact (**Table 5.6**). Taxa with this ecological impact rating are considered significant weeds capable of causing acute disruption of ecological processes, as well as dominating and/or significantly altering the vegetation structure, composition and function of ecosystems. Eleven introduced taxa recorded in the Study Area are rated as having 'Rapid' invasiveness in native vegetation (DBCA, 2016).

Table 5.6 Introduced Flora Taxa Recorded in the Study Area

Taxon	Common Name	Significance	Ecological Impact	Invasiveness
Casuarina glauca	Eastern Swamp Sheoak		High	Moderate
Cenchrus setaceus	Fountain Grass		High	Rapid
Cortaderia selloana	Pampas Grass		High	Rapid
Ehrharta calycina	Perennial Veldt Grass		High	Rapid
Eragrostis curvula	African Lovegrass		High	Rapid
Euphorbia terracina	Geraldton Carnation Weed		High	Rapid
Gladiolus caryophyllaceus	Pink Gladiolus		High	Rapid
Hyparrhenia hirta	Tambookie Grass		High	Rapid
Hypochaeris glabra	Smooth Cats Ear		High	Rapid
Leptospermum laevigatum	Coast Teatree		High	Rapid
Lupinus cosentinii	Sandplain Lupin		High	Moderate
Opuntia stricta[#]	Common Prickly Pear	Declared Pest; WoNS	Low	Slow
Oxalis pes-caprae	Soursob		High	Slow
Pelargonium capitatum	Rose Pelargonium		High	Rapid
Ricinus communis	Castor Oil Plant		Medium	Rapid
Washingtonia filifera	Cotton Palm		Unknown	Slow

[#]Taxon not listed in the Swan region, rating from the South-West region used instead.

5.2.5 Vegetation of the Study Area

A critical review of floristic and structural data collected at the relevé and vegetation observation points in the Study Area indicated that one VT was present in the Study Area (VT 1), as described in **Table 5.7**. This was further supported by a qualitative comparison of the vegetation in the Study Area with VTs previously mapped and described over the area as part of the On-Ramp survey by Biota (2003), as well as those described for the Perth Airport Estate flora and vegetation assessment (Woodman Environmental, 2020), located in close proximity (35 m) to the north of the Study Area (see **Section 5.1.2**) (as described below).

In addition, a transitional vegetation community was observed on the north and south side of VT 1 (two bands of approximately 5 m and 3 m respectively). However, a relevé and subsequent vegetation mapping of this area was not undertaken, partially due to the size of the area (too small to adequate survey a relevé) and also because the species present indicated a transitional community only, rather than a different, discrete community, and therefore it was considered that it could not be adequately mapped and described. This area is referenced in the Vegetation Observation Point data presented in **Appendix E**.

5.2.5.1 Qualitative Comparison of Vegetation of the Study Area with Previous Studies

Biota (2003) mapped and described five VTs as part of the Tonkin Highway on-ramp survey (see **Section 5.1.2** for overview of this study), two of which occur within the Study Area as listed below:

- *Pericalymma ellipticum* var. *ellipticum* shrubland on sumplands (sampled by one quadrat (AR03) – located in the current Study Area).
- *Banksia menziesii* woodland over mixed low shrublands on low sandy rises (sampled by four quadrats (AR01, AR02, AR05 and AR06) – with quadrats AR02 and AR05 located within the current Study Area).
- The majority of the area mapped as *Pericalymma ellipticum* var. *ellipticum* shrubland on sumplands has since been cleared with the construction of the Tonkin Highway on-ramp, and is not considered to be present in the Study Area. It is likely that the transitional vegetation community observed by the current survey located on the northern boundary of VT 1 was related to the *Pericalymma ellipticum* var. *ellipticum* VT. The remainder of this block was mapped by Biota as *Banksia menziesii* woodland over mixed low shrublands on low sandy rises. A comparison of the Biota quadrat data for this VT within the Study Area indicated that the data recorded at relevé R1 by the current survey aligned with the data recorded by Biota, although the condition of the vegetation appears to have declined slightly since this time, likely as a result of edge effects and fragmentation since construction of the on-ramp (see **Section 5.2.10** for detailed discussion regarding vegetation condition of the Study Area). Likewise, a comparison of the VT description for the *Banksia menziesii* woodland mapped by Biota was also comparable to that of the VT mapped by the current survey.

In terms of the survey undertaken adjacent to the Study Area for Perth Airport by Woodman Environmental (2020), a critical review of the VTs mapped and described by that assessment indicates that VT 1 (as described by the current survey) appears to be most closely aligned with VT 13 of the Woodman Environmental assessment, as described below:

- Low woodland to open forest of *Banksia menziesii, B. attenuata* and occasionally *Eucalyptus todtiana* over tall sparse shrubland dominated by *Adenanthos cygnorum* subsp. *cygnorum* over mid open to sparse shrubland of mixed species dominated by *Jacksonia floribunda* and *Melaleuca seriata* over low open shrubland of mixed species dominated by *Eremaea pauciflora* var. *pauciflora*, *Hibbertia hypericoides* subsp. *hypericoides*, *Scholtzia involucrata* and *Bossiaea eriocarpa* over low open to sparse sedgeland and rushland of mixed species dominated by *Alexgeorgea nitens*, *Dasypogon bromeliifolius*, *Patersonia occidentalis* var. *occidentalis*, *Desmocladus flexuosus* and *Lyginia imberbis* on dunes and low rises on grey sand.

There are nearby mapped occurrences of VT 13 approximately 50 m and 80 m north-west and north-east of the Study Area, respectively, within the Perth Airport Estate (Woodman Environmental, 2020). None of the other VTs mapped and described as part of the Perth Airport survey appeared to be closely aligned with the vegetation mapped as part of the current study.

Table 5.7 Summary of VTs Mapped in the Study Area

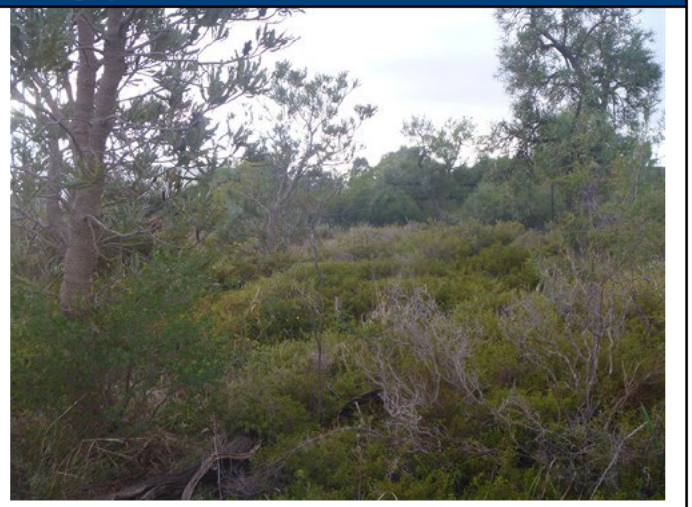
Code	Description	Photograph
VT 1	**Description:** Low open woodland of *Banksia menziesii* over mid sparse shrubland of *Melaleuca seriata* and *Xanthorrhoea preissii* over low open shrubland dominated by *Eremaea pauciflora*, *Hibbertia hypericoides* and *Styphelia conostephioides* over sparse sedgeland and rushland of mixed species dominated by *Alexgeorgea nitens*, *Desmocladus flexuosus* and *Lyginia imberbis* on undulating plains on grey sand. **Area Mapped in Study Area (Proportion of Study Area):** 0.4 ha (13.3 %) **Sample Sites:** 1 relevé (R1)	 **Photo 5.1 Relevé R1 (facing SE)**  **Photo 5.2 Relevé R1 (facing NW)**

FIGURE 5.3

Vegetation Types and Other Areas Mapped in the Study Area

Legend

- Study Area
- Railway
- Road
- Watercourse

Vegetation Types

- VT1

Highly Modified Areas

- PR
- RV
- RD
- PV
- PD
- PCD
- CI

0 60 120

Meters

Scale: 1:3,000 at A4
GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023)

Vegetation Types

VT1 Low open woodland of *Banksia menziesii* over mid sparse shrubland of *Melaleuca seriata* and *Xanthorrhoea preissii* over low open shrubland dominated by *Eremaea pauciflora*, *Hibbertia hypericoides* and *Styphelia conostephioides* over sparse sedgeland and rushland of mixed species dominated by *Alexgeorgea nitens*, *Desmocladus flexuosus* and *Lyginia imberbis* on undulating plains on grey sand.

Highly Modified Areas

PR Potential remnant trees including *Banksia menziesii* and *Corymbia calophylla*, and planted trees including *Agonis flexuosa* and *Eucalyptus* sp. over planted shrubs including *Acacia cochlearis*, *Adenanthos cygnorum*, *Banksia attenuata*, *Chamelaucium uncinatum*, *Hakea prostrata* and *Melaleuca nesophila* over weeds.

RV Revegetation area of planted shrubs including *Acacia cochlearis*, *Adenanthos cygnorum*, *Banksia attenuata*, *Banksia menziesii* and *Grevillea thelemanniana* (T - planted) over weeds.

RD Revegetation area including *Acacia cochlearis*, *Melaleuca huegelii*, *Melaleuca rhaphiophylla*, *Melaleuca teretifolia* surrounding drain area with *Typha ?domingensis*.

PV Planted trees and shrubs including *Calothamnus quadrifidus*, *Corymbia calophylla*, *Eragrostis curvula*, *Grevillea thelemanniana* (T - planted) and *Melaleuca nesophila* over weeds.

PD Planted and colonised trees and shrubs including *Casuarina glauca*, *Eucalyptus camaldulensis* and *Melaleuca nesophila* over weeds, surrounding a drain / swamp area with *Schoenoplectus tabernaemontani* and *Typha ?domingensis*.

PCD Planted and colonised trees and shrubs including *Allocasuarina fraseriana*, *Banksia littoralis*, *Calothamnus quadrifidus*, *Eucalyptus camaldulensis* and *Melaleuca rhaphiophylla* over weeds, surrounding a drain / swamp area with *Typha ?domingensis*.

CI Cleared land

FIGURE 5.3

LEGEND: Vegetation Types and Other Areas Mapped in the Study Area

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023)

5.2.6 Other Areas Described

Areas where natural vegetation has been completely removed, with virtually no native taxa remaining (isolated trees and shrubs may be present), have been mapped as 'Cleared' (Cl). This includes roads and road verges (and associated infrastructure including culverts). A total of 1 ha of 'Cleared' land was mapped, representing just over 30 % of the Study Area (**Figure 5.3**).

The majority of the Study Area has been historically cleared or disturbed, with some areas possessing remnant tree or shrub taxa, but are highly modified otherwise, with understoreys usually completely comprised of introduced taxa. In many cases the trees or shrubs are native species and have likely colonised the area following disturbance (e.g. in drains) or been planted. There are also areas that have undergone revegetation. All of the above-described areas have therefore been mapped as 'Highly Modified Areas', and no attempt has been made to align or describe any such areas to VTs. A total of six 'Highly Modified Areas' were mapped, representing just over 50 % of the Study Area. **Table 5.8** outlines the different types of 'Highly Modified Areas' mapped in the Study Area.

Table 5.8 Description of Highly Modified Areas Mapped in the Study Area

Code	Description	Photograph
Cl	**Description:** Cleared land consisting of areas where natural vegetation has been completely removed, with virtually no native taxa remaining (isolated trees and shrubs may be present). **Area Mapped in Study Area (Proportion of Study Area):** 1.0 ha (33.8 %)	-
PCD	**Description:** Planted and colonised trees and shrubs including *Allocasuarina fraseriana*, *Banksia littoralis*, *Calothamnus quadrifidus*, *Eucalyptus camaldulensis* and *Melaleuca rhaphiophylla* over weeds, surrounding a drain / swamp area with *Typha ?domingensis*. **Area Mapped in Study Area (Proportion of Study Area):** 0.2 ha (7.8 %)	 **Photo 5.3 VOP7 (facing NW)**
PD	**Description:** Planted and colonised trees and shrubs including *Casuarina glauca*, *Eucalyptus camaldulensis* and *Melaleuca nesophila* over weeds, surrounding a drain / swamp area with *Schoenoplectus tabernaemontani* and *Typha ?domingensis*. **Area Mapped in Study Area (Proportion of Study Area):** 0.5 ha (16.1 %)	 **Photo 5.4 VOP6 (facing NE)**

Code	Description	Photograph
PR	**Description:** Potential remnant trees including *Banksia menziesii* and *Corymbia calophylla*, and planted trees including *Agonis flexuosa* and *Eucalyptus* sp. over planted shrubs including *Acacia cochlearis*, *Adenanthos cygnorum*, *Banksia attenuata*, *Chamelaucium uncinatum*, *Hakea prostrata* and *Melaleuca nesophila* over weeds. **Area Mapped in Study Area (Proportion of Study Area):** 0.2 ha (5.5 %)	 **Photo 5.5 VOP2 (facing SE)**
PV	**Description:** Planted trees and shrubs including *Calothamnus quadrifidus*, *Corymbia calophylla*, *Grevillea thelemanniana* (T) - planted) and *Melaleuca nesophila* over weeds (including high levels of **Eragrostis curvula*). **Area Mapped in Study Area (Proportion of Study Area):** 0.2 ha (5.2 %)	 **Photo 5.6 VOP5 (facing SE)**
RD	**Description:** Revegetation area including *Acacia cochlearis*, *Melaleuca huegelii*, *Melaleuca rhaphiophylla* and *Melaleuca teretifolia* surrounding drain area with *Typha ?domingensis.* **Area Mapped in Study Area (Proportion of Study Area):** 0.3 ha (9.6 %)	 **Photo 5.7 VOP4 (facing NW)**
RV	**Description:** Revegetation area of planted shrubs including *Acacia cochlearis*, *Adenanthos cygnorum*, *Banksia attenuata*, *Banksia menziesii* and *Grevillea thelemanniana* (T) - planted) over weeds. **Area Mapped in Study Area (Proportion of Study Area):** 0.3 ha (9.8 %)	 **Photo 5.8 RV Area (facing SE)**

5.2.7 Swan Coastal Plain Floristic Community Types

The current procedure recommended by DBCA for determining FCTs on the southern SCP is to establish and survey quadrats in the appropriate season and carry out analyses with the Gibson et. al. (1994) and Keighery et.al. (2012) datasets as per the 'Methods for survey and identification of Western Australian threatened ecological communities' document (DBCA, 2023c). The current survey does not comply with this procedure as it was an out of season survey and the timing was not suitable to undertake a quadrat survey of the flora and vegetation; as per **Section 1.3**, one of the aims of the current assessment was to identify whether there is a requirement for quadrat assessment, based on the vegetation present in the Study Area and the condition of the vegetation.

The majority of the Study Area has been cleared or disturbed (see **Section 5.2.6**), with remnant vegetation only occurring within the area mapped as VT 1 (adjacent to the Tonkin Highway on-ramp). This is a small fragmented area covering 0.4 ha, which is isolated from all other native vegetation areas by revegetated and cleared areas (roads / highways) (**Figure 5.3**). The vegetation condition of the majority of VT 1 was rated as Very Good as per the condition scale presented in EPA (2016b), with the vegetation structure being altered by obvious signs of disturbances (see **Section 5.2.10**). However, the outer edge of VT 1 was also traversed and was rated as Good, with this area experiencing increasing levels of aggressive weeds and edge effects. Given the majority of VT 1 is in Very Good condition, a spring quadrat assessment (specifically within the area mapped as VT 1) and subsequent statistical analyses of this quadrat data is recommended under the requirements for survey and identification of WA TECs procedure (DBCA, 2023c).

Nevertheless, as there have been previous studies undertaken within or in close proximity to the Study Area, a brief review of quadrat data and analyses results from these surveys, in combination with a qualitative assessment of the vegetation recorded in the Study Area, was undertaken to identify the SCP FCT(s) that may be present in the Study Area.

VT 1 is considered to be comparable with the '*Banksia menziesii* woodland over mixed low shrublands on low sandy rises' vegetation type mapped and described by Biota (2003) within the Study Area (see **Section 5.2.5.1**). Analyses (dendrogram production and nearest neighbour analysis) of the Biota (2003) quadrats (those undertaken within the current Study Area) and the Gibson et. al. (1994) dataset resulted in the nearest neighbour analysis indicating affinities to FCT 23a, and dendrogram classification indicating affinities to FCT 21c, with Trudgen (2003) concluding that both quadrats AR02 and AR05 were referrable to FCT 23a. The results were the same for the quadrats assessed by Trudgen within the *Banksia menziesii* VT located to the north of the Study Area. The remaining quadrat located within the Study Area (within the *Pericalymma ellipticum* var. *ellipticum* shrubland VT) was aligned to FCT 4; however, the majority of this area has since been cleared and is not considered to be present within the Study Area (see **Section 5.2.5.1**)

VT 1 is also considered to be comparable to VT 13 as mapped and described by Woodman Environmental (2020), located north of the Study Area (see **Section 5.2.5.1**). Analyses (dendrogram classification) undertaken by Woodman Environmental (2020) of the entire Woodman Environmental quadrat dataset, and single site insertion of five representative quadrats from VT 13 with the Gibson et. al. (1994) and Keighery et. al. (2012) datasets resulted in the majority of VT 13 quadrats being determined as FCT 23a.

Despite limited data being available for VT 1 due to the out of season survey and its condition, a qualitative assessment of the relevé data recorded at R1 as part of the current survey was also undertaken to assess for the SCP FCT potentially present within the Study Area. The description of each FCT and the typical / common species described in the Gibson et. al. (1994) report was reviewed. The review concluded that VT 1 is most similar to FCT 23a.

Overall, it is considered most likely that the vegetation mapped as VT 1 is representative of SCP FCT 23a. This FCT can form part of the Banksia Woodlands of the Swan Coastal Plain ecological community' (discussed in **Section 5.2.8.1**) but is not itself a listed TEC or PEC (DBCA, 2018, 2023e). The establishment of a quadrat in spring and subsequent analysis of data is required to confirm this. However, it is possible that the reduced suite of species due to the condition of the vegetation could potentially have an impact on analyses (if undertaken), which could reduce the chance of an accurate and/or conclusive result.

5.2.8 Significant Vegetation

The desktop assessment identified 17 listed significant vegetation communities that have records (or could potentially occur) within the Desktop Study Area (**Section 5.1.4**). Of these, one was identified by the flora and vegetation assessment in the Study Area, being the 'Banksia Woodlands of the Swan Coastal Plain ecological community' TEC. This TEC is listed under the EPBC Act but is listed as a PEC (P3) by DBCA. This significant vegetation community is discussed in further detail in **Section 5.2.8.1**.

5.2.8.1 Banksia Woodlands of the Swan Coastal Plain TEC

The 'Banksia Woodlands of the Swan Coastal Plain ecological community' is listed as a PEC (P3) in WA, and as a TEC under Commonwealth legislation. DBCA state that the description, area and condition thresholds that apply to the EPBC-listed TEC, also apply to the PEC (DBCA, 2023e); therefore, these are discussed together in the context of the EPBC-listed TEC. Note that a number of other DBCA-listed TECs and PECs (based on SCP FCTs from the Gibson et al. (1994) study) also form part of the EPBC-listed TEC; these other communities are discussed in **Section 5.2.9**.

The Banksia Woodlands of the SCP TEC was once continuously distributed across a large region. Currently, it is fragmented into numerous small and scattered patches. Critical habitat for the TEC includes all patches that meet the diagnostic characteristics and condition thresholds for the community, as well as buffer zones, particularly where these zones contain native vegetation. Areas that do not meet minimum condition threshold may also be critical to the survival of the TEC depending upon factors such as size and shape and linkages. As of March 2019, approximately 22.5 % of the extant extent of the TEC in the Perth IBRA subregion was in lands managed for conservation (IUCN category I-IV reserves) (DoEE, 2016). The Approved Conservation Advice for this community (DoEE, 2016) stipulates a stepwise process for identifying occurrences of the TEC community, as presented in **Appendix F**. These steps are followed in the context of identifying whether vegetation of the Study Area represents this TEC, as outlined below.

The first step involves assessment against key diagnostic characteristics (location and physical environment, soils and landform, structure, and composition). The Study Area satisfies the first two key diagnostic characteristics, as it occurs within the SCP IBRA bioregion, and contains areas of well drained, low nutrient soils on sandplain landforms. With regard to the remaining two key diagnostic characteristics, VT 1 is considered to possess these characteristics, as it has a basic structure that includes a low woodland dominated by *Banksia menziesii*, over a relatively diverse understorey that includes sclerophyllous shrubs and a herbaceous ground layer. It is acknowledged that in some parts of this VT, the diagnostic *Banksia* tree

taxa may occur as isolated trees only. However, as outlined in the Approved Conservation Advice under the fourth step of the identification process (further information to assist in determining the presence of the community), this form variation often occurs in patches of the TEC, and therefore does not preclude such areas from being included as part of a larger occurrence of the TEC. A single, small potential patch was identified within the Study Area using this definition, corresponding to the mapped extent of VT 1 in the Study Area (see **Figure 5.3**).

The next steps involve applying condition and size (spatial area) thresholds to patches of vegetation that meet the key diagnostic characteristics; a patch is defined as a discrete and mostly continuous area of the TEC, typically with any breaks (i.e. tracks, roads, or vegetation that does not represent the TEC) being less than 30 m in distance. Where there is a break in native vegetation cover from the edge of the tree canopy of 30 m or more (e.g. due to permanent artificial structures, wide roads or other barriers; or due to water bodies typically more than 30 m wide) then the gap typically indicates that separate patches are present.

The Approved Conservation Advice then specifies that a patch of the TEC must meet the 'Good' vegetation condition category as per Gibson et al. (1994) to be considered a patch of the TEC under the EPBC Act; this is the same vegetation condition scale presented in EPA Technical Guidance (EPA, 2016c) that has been used by this current assessment (**Section 3.3.6**). It then defines minimum patch sizes for each condition rating (Good and higher). However, as outlined under the fourth step of the Approved Conservation Advice, it is stipulated that a patch can vary in condition, and can include vegetation with a lower condition rating than Good; such areas may still retain important natural values and may be critical to protecting those portions of a patch that meet the condition threshold.

In the case of the single potential patch identified in the Study Area, the potential patch was mapped as being in Very Good condition, with this rating used when assessing the patch against the minimum patch size requirements. Given that the potential patch is only 0.4 ha, this patch does not meet patch size requirements under the conservation advice (DoEE, 2016) (**Appendix F**) and is not considered to represent an occurrence of the TEC. Although there have been occurrences of the TEC mapped nearby for the Perth Airport Estate flora and vegetation assessment (Woodman Environmental, 2020), the break in native vegetation cover from the occurrence of VT 1 to the nearest patch (mapped at Perth Airport) is greater than 30 m or more (due to a wide road), and there are no other occurrences of Banksia woodland located within 30 m based on field observations and aerial photography interpretation.

5.2.9 Likelihood of Occurrence of Further Significant Vegetation

Table 5.9 presents an assessment of the likelihood of further significant vegetation occurring within the Study Area, with regard to significant vegetation identified as occurring in the Desktop Study Area (**Section 5.1.4**). As outlined in **Table 5.9**, it is considered unlikely that any further significant vegetation occurs in the Study Area.

No quadrats and statistical analyses were undertaken as part of this assessment (see **Section 5.2.7**) due to the field survey being conducted out of season. However, the presence of significant vegetation in relation to SCP FCTs was assessed as much as possible, referencing previous data recorded within and adjacent to the Study Area, and utilising the results of those analyses in comparison to vegetation recorded in the Study Area (discussed in detail in **Section 5.2.7**).

Table 5.9 Likelihood of Occurrence of Further Significant Vegetation Communities in the Study Area

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP 21c – Low lying *Banksia attenuata* woodlands or shrublands (P3 – WA)	This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regelia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla.* Structurally, this community type may be either a woodland or occasionally shrubland. This community can be a component of the 'Banksia Woodlands of the SCP ecological community' EPBC-listed TEC.	1.9 km SW of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. *Banksia attenuata*, *Melaleuca preissiana*, *Regelia ciliata*, *Eucalyptus marginata* and *Corymbia calophylla* were not dominant and / or not recorded within VT 1.
Clay Pans of the Swan Coastal Plain (Critically Endangered – EPBC Act)	The clay pan communities occur where clay substrate is low in the landscape and forms an impermeable layer close to the surface. These wetlands that rely on rainfall and local surface drainage to fill are considered unlikely to be connected to groundwater. The clay pans then dry out to form a relatively impervious substrate in summer. A suite of perennial plants that propagate by underground bulbs, tubers or corms (geophytes), and annual herbs flower sequentially as the clay pans dry out. The clay pans are the most diverse of the SCP wetlands and contain a number of local endemic flora.	DCCEEW: Community likely to occur within area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The required substrate (clay soils) were not recorded in the Study Area, and there are no natural clay pans within the Study Area.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP07 – Herb rich saline shrublands in clay pans (Vulnerable – WA) Component of 'Clay Pans of the Swan Coastal Plain' (Critically Endangered – EPBC)	The community is generally dominated by *Melaleuca viminea* (mohan), *Melaleuca osullivanii*, *Melaleuca cuticularis* (saltwater paperbark) or *Casuarina obesa* (swamp sheoak) or a mixture of these species. It has been recorded between Mogumber and Ambergate on heavy clay soils that are generally inundated from winter to mid-summer. The species *Melaleuca cuticularis* and *Casuarina obesa* may indicate some saline influence for at least part of the year. Herbs such as *Brachyscome bellidioides*, *Centrolepis polygyna* (wiry centrolepis), *Pogonolepis stricta* (stiff angianthus) and *Cotula coronopifolia* (waterbuttons; note: listed as alien in Florabase) are typical of this community. In addition, species such as *Angianthus drummondii* (P3), *Eryngium pinnatifidum* subsp. Palustre (P3) and *Blennospora drummondii* occur in the community at low frequency. A suite of annual flora is seen in the community as the season progresses. In early spring many of the occurrences of the community are covered by free water up to 30cm deep. *Cotula coronopifolia* sometimes forms yellow floating mats in some pools while others may be dominated by *Ornduffia submersa* (P4). Aquatic species are common in the community early in the growing season. As the wetland dries a succession of species such as *Centrolepis* spp. and annual *Stylidium* spp. successively germinate, grow and flower, resulting in an extended flowering period of over three months.	3.6 km S of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The required substrate (clay soils) were not recorded in the Study Area, and there are no natural saline clay pans within the Study Area.
SCP08 – Herb rich shrublands in clay pans (Vulnerable – WA) Component of 'Clay Pans of the Swan Coastal Plain' (Critically Endangered – EPBC)	The community has been recorded between Bullsbrook and Ludlow and occurs in low-lying flats with a clay impeding layer that facilitates seasonal inundation. The vegetation can be dominated by *Viminaria juncea* (swishbush), *Melaleuca viminea* (mohan), *Melaleuca lateritia* (robin redbreast bush) or *Melaleuca osullivanii* (broombush) but also occasionally by *Eucalyptus wandoo* (wandoo). Commonly occurring flora include *Hypocalymma angustifolium* (white myrtle), *Acacia lasiocarpa* var. *bracteolata* (long peduncle form) and *Verticordia huegelii* (variegated featherflower), and aquatic annuals.	3.5 km SSE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The required substrate (clay soils) were not recorded in the Study Area, and there are no natural clay pans within the Study Area.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP10a – Shrublands on dry clay flats (Endangered – WA) Component of 'Clay Pans of the Swan Coastal Plain' (Critically Endangered – EPBC)	The community occurs on clay flats with thin skeletal soils and has been recorded largely between Wattle Grove and Sabina River. It comprises rapidly drying clay flats. Typical and common shrubs include *Hakea sulcata* (furrowed hakea), *Verticordia densiflora* (compacted featherflower), *Hakea varia* (variable-leaved hakea), *Pericalymma ellipticum* (swamp teatree) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia), *Centrolepis aristata* (pointed centrolepis), *Drosera gigantea* (giant sundew) and *Drosera menziesii* (pink rainbow) also commonly occur.	3 km SSE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The required substrate (clay soils) were not recorded in the Study Area, and there are no natural clay flats within the Study Area.
SCP20c – Shrublands and Woodlands of the eastern Swan Coastal Plain (Endangered – EPBC, Critically Endangered – WA)	The community occurs mainly on the transitional soils of the Ridge Hill Shelf, on the SCP adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the SCP. It has been recorded between Stratton and Maddington. It generally comprises a shrubland or woodland of *Banksia attenuata* (slender banksia) and *Banksia menziesii* (firewood banksia), sometimes with *Allocasuarina fraseriana* (western sheoak), over a shrub layer that can include the species *Adenanthos cygnorum* (woolybush), *Hibbertia huegelii*, *Scaevola repens* var. *repens* (fan flower), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Hibbertia hypericoides* (yellow buttercups) and *Stirlingia latifolia* (blueboy). A suite of herbs including *Conostylis aurea* (golden conostylis), *Trachymene pilosa* (native parsnip), *Lomandra hermaphrodita, Burchardia congesta* (milkmaids) and *Patersonia occidentalis* (purple flag), and the sedges *Mesomelaena pseudostygia* (semaphore sedge) and *Lyginia barbata* usually occur in the community.	2.8 km NE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The Study Area is not adjacent to the Darling Scarp, or on the alluvial clays deposited on the eastern fringe of the SCP.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP3a – *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan (Endangered – EPBC, Critically Endangered – WA)	The community has been recorded from heavy soils of the eastern side of the southern SCP largely between Capel and Chittering. Typical native taxa in the community are the tree *Corymbia calophylla* (marri), the shrubs *Banksia dallanneyi* (couch honeypot), *Philotheca spicata* (pepper and salt), *Kingia australis* (kingia) and *Xanthorrhoea preissii* (balga), and the herbs, rushes and sedges *Cyathochaeta avenacea*, *Dampiera linearis* (common dampiera), *Haemodorum laxum*, *Desmocladus fasciculatus*, *Mesomelaena tetragona* (semaphore sedge) and *Morelotia octandra*.	0.7 NE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. Heavy soils were not recorded in the Study Area, and the species composition of remnant vegetation in the Study Area does not correspond to that of FCT 3a.
SCP3b – *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (Endangered – WA)	The community is known from the eastern side of the SCP largely between Wannamal and Dunsborough. Most occurrences of the community are dominated by both *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) with additional common taxa comprising low shrubs, sedges, grasses and herbs. These include *Bossiaea eriocarpa* (common brown pea), *Conostylis juncea*, *Hibbertia hypericoides* (yellow buttercups), *Morelotia octandra*, *Chamaescilla corymbosa* (blue squill), *Desmocladus fasciculatus*, *Banksia dallanneyi* (couch honeypot), *Mesomelaena tetragona* (semaphore sedge), *Babingtonia camphorosmae* (camphor myrtle), *Lepidosperma squamatum*, *Neurachne alopecuroidea* (foxtail mulga grass), *Philotheca spicata* (pepper and salt), *Burchardia congesta* (milkmaids), *Caesia micrantha* (pale grass-lily), *Kingia australis* (kingia), *Drosera erythrorhiza* (red ink sundew), *Lomandra hermaphrodita* and *Caladenia flava* (cowslip orchid).	3.3 NE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area (one occurrence was recorded by Woodman Environmental (2020); however not in close proximity to the Study Area). Critical review of the community in conjunction with Study Area data did not indicate that the community is present. Sandy clay soils were not recorded in the Study Area, and the species composition of remnant vegetation in the Study Area does not correspond to that of FCT 3b.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP3c – *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (Endangered – EPBC, Endangered – WA)	The community occurs on heavy soils of the eastern side of the southern SCP, generally between Bullsbrook and Stratham. The community is usually dominated by *Corymbia calophylla* (marri) and *Xanthorrhoea preissii* (balga). It also occasionally includes *Eucalyptus wandoo* (wandoo). The more common shrubs include *Gompholobium marginatum*, *Hypocalymma angustifolium* (white myrtle) and *Banksia dallanneyi* (couch honeypot), with herbs, grasses and sedges including *Burchardia congesta* (milkmaids), *Cyathochaeta avenacea*, *Neurachne alopecuroidea* (foxtail mulga grass), *Caesia micrantha* (pale grass-lily), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra*, *Desmocladus flexuosus, Opercularia vaginata* (dog weed), *Sowerbaea laxiflora* (purple tassels), *Lepidosperma* spp. and *Drosera menziesii* (pink rainbow) also common.	3 km ESE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. The species composition of remnant vegetation in the Study Area does not correspond to that of FCT 3c.
SCP15 – Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (Vulnerable – WA)	The community has been recorded from Bambun to Nirimba, on alluvial sediments on sites that are inundated for long periods resulting in more typical aquatic and flora of deeper wetlands. The community is generally dominated by *Melaleuca rhaphiophylla* (swamp paperbark) or *Casuarina obesa* (swamp sheoak). Other species can include *Melaleuca teretifolia* (banbar), *Atriplex cinerea* (grey saltbush), *Samolus repens* (creeping brookweed), *Salicornia quinqueflora* (beaded samphire) and *Sporobolus virginicus (*marine couch).	1.8 km N of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area (one occurrence was recorded by Woodman Environmental (2020); however not in close proximity to the Study Area). Critical review of the community in conjunction with Study Area data did not indicate that the community is present. No natural wetlands with remnant vegetation were recorded in the Study Area.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
SCP02 – Southern wet shrublands, Swan Coastal Plain (Critically Endangered – WA)	The community typically comprises shrublands or open woodlands. It occurs on seasonally inundated sandy clay soils that are restricted to small remnants on the eastern side of the SCP. It has been recorded from Forrestfield to Chapman Hill. The community has moderate species richness with the occurrence of species reflecting the wetter nature of the sites. Typical and common native taxa in the community are the shrubs *Kingia australis* (kingia), *Pericalymma ellipticum* (swamp teatree), *Hakea ceratophylla* (horned leaf hakea), *Calothamnus lateralis*, *Hypocalymma angustifolium* (white myrtle), *Eutaxia virgata*, *Stirlingia latifolia* (blueboy), *Banksia dallanneyi* (couch honeypot) and herbs, rushes and sedges including *Dampiera linearis* (common dampiera), *Comesperma virgatum* (milkwort), *Stylidium brunonianum* (pink fountain triggerplant), *Thysanotus multiflorus* (many-flowered fringe lily) and *Mesomelaena tetragona* (semaphore sedge). The community also contains priority flora including *Isopogon formosus* subsp. *dasylepis* (P3) and *Grevillea brachystylis* subsp. *brachystylis* (P3).	0.02 km SE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. Inundated clay soils were not recorded within remnant vegetation in the Study Area.
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain (Endangered – EPBC, Endangered – WA)	The community occurs on the heavy soils of the eastern side of the SCP and has been recorded between Beermullah and Wokalup. Known patches include wetland and well-drained habitats, in a variety of landforms. It is defined on the basis of substrates with a limestone influence. Many of the species are commonly associated with the limestone soils that occur on the coast, and do not generally occur further inland. Typical and common native species in areas of best developed limestone are: the tree *Casuarina obesa* (swamp sheoak); the mallees *Eucalyptus decipiens* (redheart) and *Eucalyptus foecunda* (narrow-leaved red mallee); the shrubs *Melaleuca huegelii* (chenille honey-myrtle), *Alyogyne huegelii* (lilac hibiscus), *Grevillea curviloba* (endangered), *Grevillea evanescens* (priority 1) and *Melaleuca systena* (coastal honeymyrtle); and the herb *Thysanotus arenarius* (sand-dune fringed lily). Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as clay content, with the presence of calcicoles such as *Thysanotus arenarius, Gahnia trifida* (coast saw-sedge), *Eremophila glabra* (tar bush) and *Melaleuca brevifolia* (mallee honey-myrtle) providing evidence of the limestone influence. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands and *Melaleuca brevifolia*, *Melaleuca systena* or *Melaleuca viminea* shrublands have been recorded on Muchea Limestone.	2.9 km SSE of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. Areas of vegetation with limestone (or limestone influence) were not recorded in the Study Area.

Community[#]	Description[^]	Nearest Known Location	Likelihood of Occurrence
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community: TEC (Critically Endangered – EPBC Act)	Mostly confined to Quindalup Dunes and Spearwood Dunes but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands. Tuart is the key upper canopy species although it may co-occur with trees of other species. Trees commonly co-occurring with Tuart include *Agonis flexuosa*, *Banksia grandis*, *Banksia attenuata*, *Eucalyptus marginata*; and less commonly, *Corymbia calophylla*, *Banksia menziesii* and *Banksia prionotes*. An understorey of native plants is typically present, which may include grasses, herbs and shrubs. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community.	Unknown	Not present: no vegetation within the Study Area meets the diagnostic characteristics outlined in the Approved Conservation Advice for this community (DCCEEW, 2019), as *Eucalyptus gomphocephala* was not recorded in the Study Area.
Central Northern Darling Scarp Granite Shrubland Community (P4 – WA)	Shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs *Xanthorrhoea acanthostachya* and *Allocasuarina humilis* over smaller proteaceous and myrtaceous shrubs, namely *Melaleuca* aff. *scabra*, *Baeckea camphorosmae* and to a lesser extent, the proteaceous shrubs *Dryandra armata*, *Hakea incrassata* and *Hakea undulata*. Located in central region of the Northern Darling Scarp near Perth.	4 km E of Study Area	Unlikely: Not identified to be present by previous surveys within/ adjacent to the Study Area. Critical review of the community in conjunction with Study Area data did not indicate that the community is present. Loams / red earth soils and granite/quartzite were not recorded in the Study Area.

#TECs are listed under the EPBC Act, and under the BC Act, as Critically Endangered, Endangered or Vulnerable. PECs are classified into Priority (P) categories in WA by DBCA.

^Sources are: DBCA PEC list for PEC descriptions (DBCA, 2023e), DBCA (then DPAW (2016)) for FCT 20a, Meissner & English (2005) for Perth to Gingin Ironstone Association, DBCA (then DPAW) (2015) for Clay Pans of the SCP.

5.2.10 Vegetation Condition

Table 5.9 presents the vegetation condition areas mapped within the Study Area, with the condition mapping polygons presented on **Figure 5.4**. Areas mapped as Cleared land are not included, as it is not considered appropriate to apply a vegetation condition rating to these areas.

The majority of the vegetation of the Study Area was mapped as Highly Modified Areas, and has been subject to numerous and long-term disturbances and clearing (see **Section 5.2.6**), with the remainder of the Study Area either consisting of cleared land or mapped as VT 1. All Highly Modified Areas were rated as Completely Degraded, with the structure of the vegetation considered to be no longer intact.

VT 1 is the only vegetation within the Study Area that is considered to represent remnant vegetation. The condition of the majority of VT 1 was rated as Very Good. The vegetation structure of VT 1 has been impacted by disturbances including the presence of aggressive weeds (e.g. *Ehrharta calycina* and *Leptospermum laevigatum*), disturbance associated with rabbits, edge effects and fragmentation. The outer boundary of VT 1 was rated as Good, as these impacts were at higher levels at the edges (bordering roads or previous clearing).

Table 5.10 Vegetation Condition Areas Mapped within the Study Area

VT / Area	Area Mapped (ha)					
	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded
1	-	-	0.3	0.1	-	-
Highly Modified Areas*	-	-	-	-	-	1.6
Total	**-**	**-**	**0.3**	**0.1**	**-**	**1.6**

Includes Highly Modified Areas: PCD, PD, PR, PV, RD and RV as per **Table 5.8.*

FIGURE 5.4

Vegetation Condition and Introduced Flora of the Study Area

Legend

- Study Area
- Railway
- Road
- Watercourse

Vegetation Condition

- Very Good
- Good
- Completely Degraded
- Cleared Land

Introduced Flora

- Cag **Casuarina glauca*
- Cese **Cenchrus setaceus*
- Cose **Cortaderia selloana*
- Ercu **Eragrostis curvula*
- Ehc **Ehrharta calycina*
- Eut **Euphorbia terracina*
- Glc **Gladiolus caryophyllaceus*
- Hyh **Hyparrhenia hirta*
- Hyg **Hypochaeris glabra*
- Lel **Leptospermum laevigatum*
- Luc **Lupinus cosentinii*
- Ops **Opuntia stricta*
- Oxpc **Oxalis pes-caprae*
- Pec **Pelargonium capitatum*
- Ric **Ricinus communis*
- Wfi **Washingtonia filifera*

0 60 120

Meters

Scale: 1:3,000 at A4

GDA2020 MGA Zone 50

Image Source: Landgate (2023) | **Data Source:** Landgate (2023), Umwelt (2023)

6.0 Conclusions and Recommendations

The majority of the Study Area has been previously cleared or disturbed, with only one area of remnant vegetation identified within the Study Area (the area mapped as VT 1 – discussed further below). Targeted searching for significant flora taxa (only those that were identifiable at the time of survey) and significant vegetation that was considered to potentially occur within the Study Area was undertaken at 10 m spacing within suitable habitat (all areas of VT 1).

No significant flora (excluding planted occurrences of *Grevillea thelemanniana* (T) discussed in **Section 5.2.2**) were recorded during the field survey of the Study Area. An assessment of the likelihood of occurrence of significant flora taxa identified one taxon which could occur in the Study Area, being *Poranthera moorokatta* (P2). Given this taxon is an annual species that typically emerges from September to October, it was not identifiable at the time of survey; however, VT 1 potentially represents suitable habitat for this taxon. While the likelihood of this taxon being present is reduced by the fact that only one occurrence of a *Poranthera* taxon (*Poranthera microphylla*) has been previously recorded in the Study Area (with this location likely to have been cleared/impacted during construction of the on-ramp), the potential for this taxon to occur cannot be ruled out entirely. It is therefore considered 'possible to occur' in the Study Area (within VT 1). If impacts to the vegetation within the area mapped as VT 1 are proposed, further survey would be required to ascertain whether this taxon is present. Such survey would be required to be undertaken in September in order to identify this taxon. It is considered unlikely that any other significant taxa could occur in the Study Area.

One VT was identified in the intact native vegetation in the Study Area (VT 1). This VT was described via structural vegetation classification. A further six highly modified vegetation types were described and mapped across the remainder of the Study Area within areas that still possess tree or large shrub taxa, but are highly modified otherwise; the understoreys of these areas are usually completely comprised of introduced or non-endemic native taxa.

Floristic classification analyses were not undertaken as part of the current assessment. This assessment was an out of season survey and the survey timing was not appropriate to undertake a quadrat survey of the flora and vegetation. As per **Section 1.3**, one of the aims of the current assessment was to identify whether there is a requirement for quadrat assessment, based on the vegetation present in the Study Area and the condition of the vegetation. The area mapped as VT 1 is a small (0.4 ha) fragmented area isolated from all other native vegetation areas by revegetated vegetation or major roads or highways. Previous surveys within or adjacent to the Study Area indicate that it is highly likely that the SCP FCT (as per the Gibson et. al. (1994) study) within this area would be FCT 23a, with qualitative comparisons of VT 1 with the Gibson et. al. (1994) report and associated data also indicating that VT 1 would be representative of FCT 23a.

VT 1 meets the key diagnostic characteristics for the Banksia Woodlands of the SCP TEC; however, due to the condition and size of the vegetation, this area does not meet patch size requirements as per the conservation advice for the TEC (DoEE, 2016) (see **Section 5.2.8.1** for the assessment). An assessment of the likelihood of the remaining 14 significant vegetation communities occurring within the Desktop Study Area identified that it is considered unlikely that any of these significant communities could occur within the Study Area; based on a critical review of each community in comparison with Study Area data, it was determined that habitat is not present and/or often the required substrate (such as clay soils) were also not present. In addition, none of the highly modified vegetation mapped in the Study Area are considered to

represent any formally listed TECs or PECs. It is also considered that none of the vegetation of the Study Area are significant for any other reasons as per EPA guidance (EPA, 2016a, 2016b).

Based on the results of this study, if impacts are proposed within the area mapped as VT 1, further survey should be undertaken in spring (specifically September) to survey for *Poranthera moorokatta* (P2). In addition, although it is likely that VT 1 represents SCP FCT 23a (as described by Gibson et. al. (1994)), the DBCA methods for survey and identification of WA TECs (DBCA, 2023c) require a spring quadrat assessment and analyses of quadrat data to confirm this. The remainder of the Study Area does not contain remnant native vegetation. Therefore, if disturbance to VT 1 can be avoided, no further survey is considered to be required.

7.0 References

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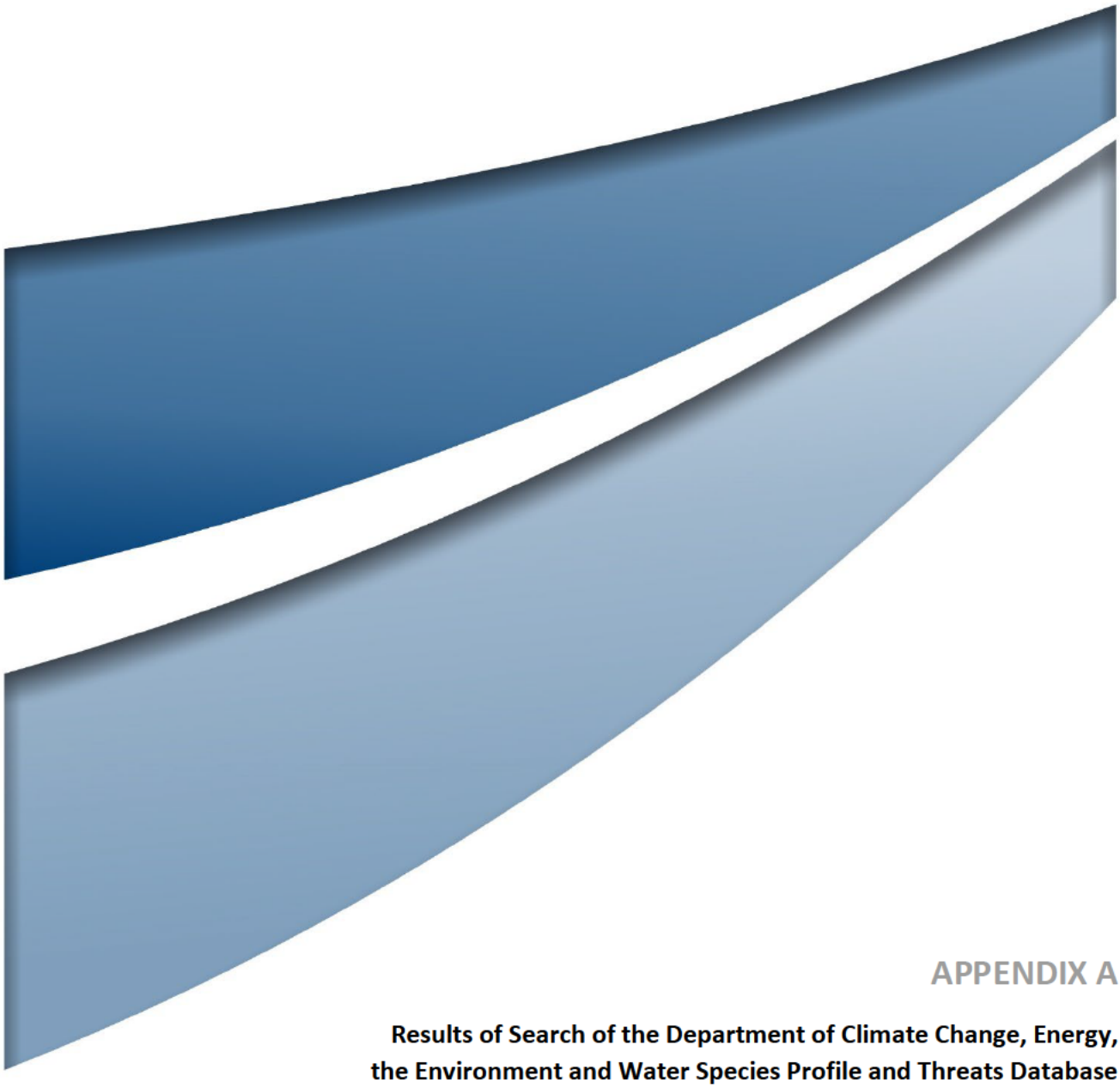

APPENDIX A

Results of Search of the Department of Climate Change, Energy, the Environment and Water Species Profile and Threats Database

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. Please see the caveat for interpretation of information provided here.

Report created: 06-Jun-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	49
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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	233
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	1
Nationally Important Wetlands:	2
EPBC Act Referrals:	24
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area	In buffer area only
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Leipoa ocellata](#) Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Pachyptila turtur subantarctica](#) Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Sternula nereis nereis](#) Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Zanda baudinii listed as Calyptorhynchus baudinii](#) Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Roosting known to occur within area	In feature area
[Zanda latirostris listed as Calyptorhynchus latirostris](#) Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Breeding known to occur within area	In feature area
INSECT			
[Leioproctus douglasiellus](#) a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
[Bettongia penicillata ogilbyi](#) Woylie [66844]	Endangered	Species or species habitat may occur within area	In buffer area only
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Setonix brachyurus](#) Quokka [229]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
OTHER			
[Westralunio carteri](#) Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat may occur within area	In buffer area only
PLANT			
[Acacia anomala](#) Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Acacia aphylla](#) Leafless Rock Wattle [13553]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area	In feature area
[Anigozanthos viridis subsp. terraspectans](#) Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Anthocercis gracilis](#) Slender Tailflower [11103]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Austrostipa bronweniae listed as Austrostipa bronwenae](#) [92773]	Endangered	Species or species habitat known to occur within area	In buffer area only
[Banksia mimica](#) Summer Honeypot [82765]	Endangered	Species or species habitat known to occur within area	In feature area
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Calytrix breviseta subsp. breviseta](#) Swamp Starflower [23879]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chamelaucium lullfitzii listed as Chamelaucium sp. Gingin (N.G.Marchant 6)			
Gingin Wax [92777]	Endangered (listed as Chamelaucium sp. Gingin	Species or species habitat may occur within area	In feature area
Conospermum undulatum			
Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat known to occur within area	In feature area
Darwinia apiculata			
Scarp Darwinia [8763]	Endangered	Species or species habitat known to occur within area	In buffer area only
Diplolaena andrewsii			
[6601]	Endangered	Species or species habitat likely to occur within area	In feature area
Diuris drummondii			
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diuris micrantha			
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diuris purdiei			
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area	In feature area
Drakaea elastica			
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area	In feature area
Drakaea micrantha			
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area	In feature area
Eleocharis keigheryi			
Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eremophila glabra subsp. chlorella			
[84927]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area	In feature area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area	In feature area
Grevillea flexuosa Zig Zag Grevillea [2957]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat known to occur within area	In buffer area only
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat known to occur within area	In feature area
Ptilotus pyramidatus Pyramid Mulla-mulla [18216]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Synaphea sp. Pinjarra Plain (A.S. George 17182) [86878]	Endangered	Species or species habitat may occur within area	In buffer area only
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - AIRTC CANNINGTON [50233]	WA	In buffer area only
Defence - AIRTC CANNINGTON [50230]	WA	In buffer area only
Defence - AIRTC CANNINGTON [50232]	WA	In buffer area only
Defence - AIRTC CANNINGTON [50231]	WA	In buffer area only
Defence - AIRTC CANNINGTON [50229]	WA	In buffer area only
Unknown		
Commonwealth Land - [51181]	WA	In buffer area only
Commonwealth Land - [51353]	WA	In buffer area only
Commonwealth Land - [51352]	WA	In buffer area only
Commonwealth Land - [51923]	WA	In buffer area only
Commonwealth Land - [51918]	WA	In feature area
Commonwealth Land - [51917]	WA	In feature area
Commonwealth Land - [51915]	WA	In buffer area only
Commonwealth Land - [51916]	WA	In buffer area only
Commonwealth Land - [51913]	WA	In buffer area only
Commonwealth Land - [51914]	WA	In buffer area only
Commonwealth Land - [51327]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51326]	WA	In buffer area only
Commonwealth Land - [51325]	WA	In buffer area only
Commonwealth Land - [51306]	WA	In buffer area only
Commonwealth Land - [51321]	WA	In buffer area only
Commonwealth Land - [51320]	WA	In buffer area only
Commonwealth Land - [51333]	WA	In buffer area only
Commonwealth Land - [50843]	WA	In buffer area only
Commonwealth Land - [51359]	WA	In buffer area only
Commonwealth Land - [51328]	WA	In buffer area only
Commonwealth Land - [51358]	WA	In buffer area only
Commonwealth Land - [50844]	WA	In buffer area only
Commonwealth Land - [51332]	WA	In buffer area only
Commonwealth Land - [50847]	WA	In buffer area only
Commonwealth Land - [51330]	WA	In buffer area only
Commonwealth Land - [51356]	WA	In buffer area only
Commonwealth Land - [51357]	WA	In buffer area only
Commonwealth Land - [51354]	WA	In buffer area only
Commonwealth Land - [51427]	WA	In buffer area only
Commonwealth Land - [51180]	WA	In buffer area only
Commonwealth Land - [51276]	WA	In buffer area only
Commonwealth Land - [51231]	WA	In buffer area only
Commonwealth Land - [51268]	WA	In feature area
Commonwealth Land - [51232]	WA	In buffer area only
Commonwealth Land - [51907]	WA	In feature area
Commonwealth Land - [51198]	WA	In buffer area only
Commonwealth Land - [51230]	WA	In buffer area only
Commonwealth Land - [51197]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51233]	WA	In buffer area only
Commonwealth Land - [51922]	WA	In buffer area only
Commonwealth Land - [51334]	WA	In buffer area only
Commonwealth Land - [51335]	WA	In buffer area only
Commonwealth Land - [51338]	WA	In buffer area only
Commonwealth Land - [51339]	WA	In buffer area only
Commonwealth Land - [51336]	WA	In buffer area only
Commonwealth Land - [51337]	WA	In buffer area only
Commonwealth Land - [51235]	WA	In buffer area only
Commonwealth Land - [51234]	WA	In buffer area only
Commonwealth Land - [51237]	WA	In buffer area only
Commonwealth Land - [51236]	WA	In buffer area only
Commonwealth Land - [51316]	WA	In buffer area only
Commonwealth Land - [51317]	WA	In buffer area only
Commonwealth Land - [51314]	WA	In buffer area only
Commonwealth Land - [51315]	WA	In buffer area only
Commonwealth Land - [51312]	WA	In buffer area only
Commonwealth Land - [51344]	WA	In buffer area only
Commonwealth Land - [51313]	WA	In buffer area only
Commonwealth Land - [51345]	WA	In buffer area only
Commonwealth Land - [51347]	WA	In buffer area only
Commonwealth Land - [51906]	WA	In buffer area only
Commonwealth Land - [50850]	WA	In buffer area only
Commonwealth Land - [51909]	WA	In buffer area only
Commonwealth Land - [51908]	WA	In buffer area only
Commonwealth Land - [51246]	WA	In buffer area only
Commonwealth Land - [50859]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51307]	WA	In buffer area only
Commonwealth Land - [51291]	WA	In buffer area only
Commonwealth Land - [51285]	WA	In buffer area only
Commonwealth Land - [51290]	WA	In buffer area only
Commonwealth Land - [51284]	WA	In buffer area only
Commonwealth Land - [51293]	WA	In buffer area only
Commonwealth Land - [51283]	WA	In buffer area only
Commonwealth Land - [51292]	WA	In buffer area only
Commonwealth Land - [50873]	WA	In buffer area only
Commonwealth Land - [50874]	WA	In buffer area only
Commonwealth Land - [51355]	WA	In buffer area only
Commonwealth Land - [51299]	WA	In buffer area only
Commonwealth Land - [51297]	WA	In buffer area only
Commonwealth Land - [51189]	WA	In buffer area only
Commonwealth Land - [51207]	WA	In feature area
Commonwealth Land - [51350]	WA	In buffer area only
Commonwealth Land - [51286]	WA	In buffer area only
Commonwealth Land - [51329]	WA	In buffer area only
Commonwealth Land - [51274]	WA	In buffer area only
Commonwealth Land - [51277]	WA	In buffer area only
Commonwealth Land - [51296]	WA	In buffer area only
Commonwealth Land - [51275]	WA	In buffer area only
Commonwealth Land - [51206]	WA	In buffer area only
Commonwealth Land - [51192]	WA	In buffer area only
Commonwealth Land - [51205]	WA	In buffer area only
Commonwealth Land - [51193]	WA	In buffer area only
Commonwealth Land - [51208]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51194]	WA	In buffer area only
Commonwealth Land - [51201]	WA	In buffer area only
Commonwealth Land - [51195]	WA	In buffer area only
Commonwealth Land - [51294]	WA	In buffer area only
Commonwealth Land - [51188]	WA	In buffer area only
Commonwealth Land - [51190]	WA	In buffer area only
Commonwealth Land - [51191]	WA	In buffer area only
Commonwealth Land - [51369]	WA	In buffer area only
Commonwealth Land - [51209]	WA	In feature area
Commonwealth Land - [51288]	WA	In buffer area only
Commonwealth Land - [51295]	WA	In buffer area only
Commonwealth Land - [51289]	WA	In buffer area only
Commonwealth Land - [51971]	WA	In buffer area only
Commonwealth Land - [50885]	WA	In buffer area only
Commonwealth Land - [51281]	WA	In buffer area only
Commonwealth Land - [51282]	WA	In buffer area only
Commonwealth Land - [51361]	WA	In buffer area only
Commonwealth Land - [51360]	WA	In buffer area only
Commonwealth Land - [51199]	WA	In buffer area only
Commonwealth Land - [51362]	WA	In buffer area only
Commonwealth Land - [51224]	WA	In buffer area only
Commonwealth Land - [51225]	WA	In buffer area only
Commonwealth Land - [51226]	WA	In buffer area only
Commonwealth Land - [51227]	WA	In buffer area only
Commonwealth Land - [51203]	WA	In buffer area only
Commonwealth Land - [51204]	WA	In buffer area only
Commonwealth Land - [51972]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51202]	WA	In buffer area only
Commonwealth Land - [51367]	WA	In buffer area only
Commonwealth Land - [51200]	WA	In buffer area only
Commonwealth Land - [51368]	WA	In buffer area only
Commonwealth Land - [51221]	WA	In buffer area only
Commonwealth Land - [51196]	WA	In buffer area only
Commonwealth Land - [51228]	WA	In buffer area only
Commonwealth Land - [51229]	WA	In buffer area only
Commonwealth Land - [51910]	WA	In feature area
Commonwealth Land - [51911]	WA	In buffer area only
Commonwealth Land - [51912]	WA	In buffer area only
Commonwealth Land - [51222]	WA	In buffer area only
Commonwealth Land - [51220]	WA	In feature area
Commonwealth Land - [51223]	WA	In buffer area only
Commonwealth Land - [51179]	WA	In buffer area only
Commonwealth Land - [51178]	WA	In buffer area only
Commonwealth Land - [51265]	WA	In buffer area only
Commonwealth Land - [51264]	WA	In buffer area only
Commonwealth Land - [51267]	WA	In feature area
Commonwealth Land - [51266]	WA	In feature area
Commonwealth Land - [51170]	WA	In buffer area only
Commonwealth Land - [51302]	WA	In buffer area only
Commonwealth Land - [51172]	WA	In buffer area only
Commonwealth Land - [51173]	WA	In buffer area only
Commonwealth Land - [51324]	WA	In buffer area only
Commonwealth Land - [51300]	WA	In buffer area only
Commonwealth Land - [51301]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51269]	WA	In buffer area only
Commonwealth Land - [51303]	WA	In buffer area only
Commonwealth Land - [51920]	WA	In buffer area only
Commonwealth Land - [51305]	WA	In buffer area only
Commonwealth Land - [51304]	WA	In buffer area only
Commonwealth Land - [51262]	WA	In buffer area only
Commonwealth Land - [51263]	WA	In buffer area only
Commonwealth Land - [51219]	WA	In feature area
Commonwealth Land - [51214]	WA	In buffer area only
Commonwealth Land - [51215]	WA	In buffer area only
Commonwealth Land - [51216]	WA	In buffer area only
Commonwealth Land - [51217]	WA	In buffer area only
Commonwealth Land - [51210]	WA	In feature area
Commonwealth Land - [51211]	WA	In feature area
Commonwealth Land - [51163]	WA	In buffer area only
Commonwealth Land - [51212]	WA	In buffer area only
Commonwealth Land - [51213]	WA	In buffer area only
Commonwealth Land - [51373]	WA	In buffer area only
Commonwealth Land - [51278]	WA	In buffer area only
Commonwealth Land - [51279]	WA	In buffer area only
Commonwealth Land - [51166]	WA	In buffer area only
Commonwealth Land - [51167]	WA	In buffer area only
Commonwealth Land - [51187]	WA	In buffer area only
Commonwealth Land - [51165]	WA	In buffer area only
Commonwealth Land - [51272]	WA	In buffer area only
Commonwealth Land - [51273]	WA	In buffer area only
Commonwealth Land - [51270]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51175]	WA	In buffer area only
Commonwealth Land - [51176]	WA	In buffer area only
Commonwealth Land - [51174]	WA	In buffer area only
Commonwealth Land - [51177]	WA	In buffer area only
Commonwealth Land - [51351]	WA	In buffer area only
Commonwealth Land - [51271]	WA	In buffer area only
Commonwealth Land - [50862]	WA	In buffer area only
Commonwealth Land - [51349]	WA	In buffer area only
Commonwealth Land - [51342]	WA	In buffer area only
Commonwealth Land - [51323]	WA	In buffer area only
Commonwealth Land - [51348]	WA	In buffer area only
Commonwealth Land - [51341]	WA	In buffer area only
Commonwealth Land - [51346]	WA	In buffer area only
Commonwealth Land - [51343]	WA	In buffer area only
Commonwealth Land - [51340]	WA	In buffer area only
Commonwealth Land - [50849]	WA	In buffer area only
Commonwealth Land - [51322]	WA	In buffer area only
Commonwealth Land - [51248]	WA	In buffer area only
Commonwealth Land - [50860]	WA	In buffer area only
Commonwealth Land - [51298]	WA	In buffer area only
Commonwealth Land - [50861]	WA	In buffer area only
Commonwealth Land - [51280]	WA	In buffer area only
Commonwealth Land - [51245]	WA	In buffer area only
Commonwealth Land - [51244]	WA	In buffer area only
Commonwealth Land - [51249]	WA	In buffer area only
Commonwealth Land - [51310]	WA	In buffer area only
Commonwealth Land - [51164]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51921]	WA	In buffer area only
Commonwealth Land - [51311]	WA	In buffer area only
Commonwealth Land - [50836]	WA	In buffer area only
Commonwealth Land - [50835]	WA	In buffer area only
Commonwealth Land - [51924]	WA	In buffer area only
Commonwealth Land - [50837]	WA	In buffer area only
Commonwealth Land - [51319]	WA	In buffer area only
Commonwealth Land - [51318]	WA	In buffer area only
Commonwealth Land - [51256]	WA	In buffer area only
Commonwealth Land - [51255]	WA	In buffer area only
Commonwealth Land - [51258]	WA	In buffer area only
Commonwealth Land - [51257]	WA	In buffer area only
Commonwealth Land - [51218]	WA	In feature area
Commonwealth Land - [51250]	WA	In buffer area only
Commonwealth Land - [51251]	WA	In buffer area only
Commonwealth Land - [51252]	WA	In buffer area only
Commonwealth Land - [51253]	WA	In buffer area only
Commonwealth Land - [51254]	WA	In buffer area only
Commonwealth Land - [51247]	WA	In buffer area only
Commonwealth Land - [51241]	WA	In feature area
Commonwealth Land - [51242]	WA	In feature area
Commonwealth Land - [51261]	WA	In buffer area only
Commonwealth Land - [51260]	WA	In buffer area only
Commonwealth Land - [51259]	WA	In buffer area only
Commonwealth Land - [50838]	WA	In buffer area only
Commonwealth Land - [51243]	WA	In feature area
Commonwealth Land - [51308]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51309]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area overfly marine area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Canning River	Management Area	WA	In buffer area only
Dundas Road	Nature Reserve	WA	In buffer area only
Kenwick Wetlands	Nature Reserve	WA	In buffer area only
Korung	National Park	WA	In buffer area only
Lesmurdie Falls	National Park	WA	In buffer area only
Unnamed WA29815	5(1)(h) Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Unnamed WA37997	Nature Reserve	WA	In buffer area only
Unnamed WA49363	Conservation Park	WA	In buffer area only

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
South West WA RFA	Western Australia	In buffer area only

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Brixton Street Swamps	WA	In buffer area only
Perth Airport Woodland Swamps	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Southern Link Road Stage 3 City of Canning	2020/8809		Assessment	In buffer area only
Controlled action				
Airport & Freight Access Gateway	2010/5384	Controlled Action	Post-Approval	In feature area
Native vegetation clearing of Lot 21 Webster Road for Industrial Development	2011/6186	Controlled Action	Post-Approval	In buffer area only
Natural Gas Pipeline Expansion	2006/2813	Controlled Action	Post-Approval	In buffer area only
Nava-1 Cable System	2001/510	Controlled Action	Completed	In buffer area only
Roe Highway and Kalamunda Road Interchange upgrade, WA	2018/8316	Controlled Action	Post-Approval	In buffer area only
Thornlie-Cockburn Link Project, WA	2018/8188	Controlled Action	Post-Approval	In buffer area only
Tonkin Highway Grade Separated Interchanges	2019/8529	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Berkshire Road and Roe Highway Interchange, Forrestfield, East Perth, WA	2014/7243	Not Controlled Action	Completed	In buffer area only
Construction of international rowing course and commercial/residential areas	2003/1034	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed	In buffer area only
Forrestfield Airport Link, WA	2015/7399	Not Controlled Action	Completed	In buffer area only
Hartfield Park Sporting Field Extension	2013/7008	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Industrial Development (multiple lots) Edward Street, Kenwick, WA	2018/8231	Not Controlled Action	Completed	In buffer area only
Residential development of Lots 302, 308, 320 and part of Lot 9502, Hawtin Rd, Forrestfield, WA	2016/7770	Not Controlled Action	Completed	In buffer area only
Roe Highway Noise Wall, High Wycombe, WA	2014/7149	Not Controlled Action	Completed	In buffer area only
Tonkin Highway Upgrade, Guildford Road to Great Eastern Highway, WA	2019/8545	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Commercial Estate and Aeronautical Infrastructure Development, Precincts 2A & 2B	2006/3021	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
South West Metropolitan Railway Project	2003/1175	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
State Football Centre	2020/8824	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Commercial development of Lot 414 Grove Road, Kenwick	2021/9022	Referral Decision	Referral Publication	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

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

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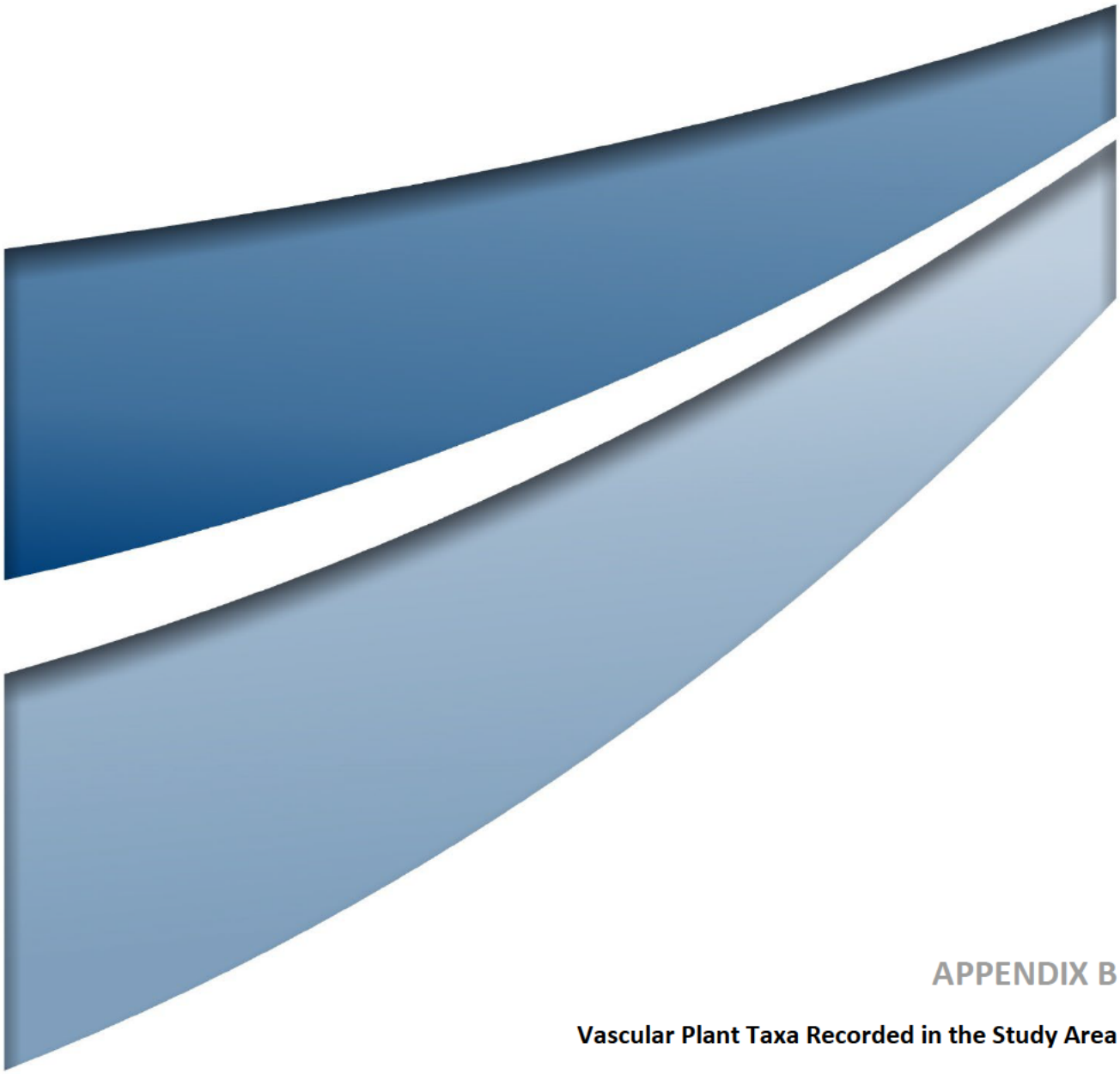


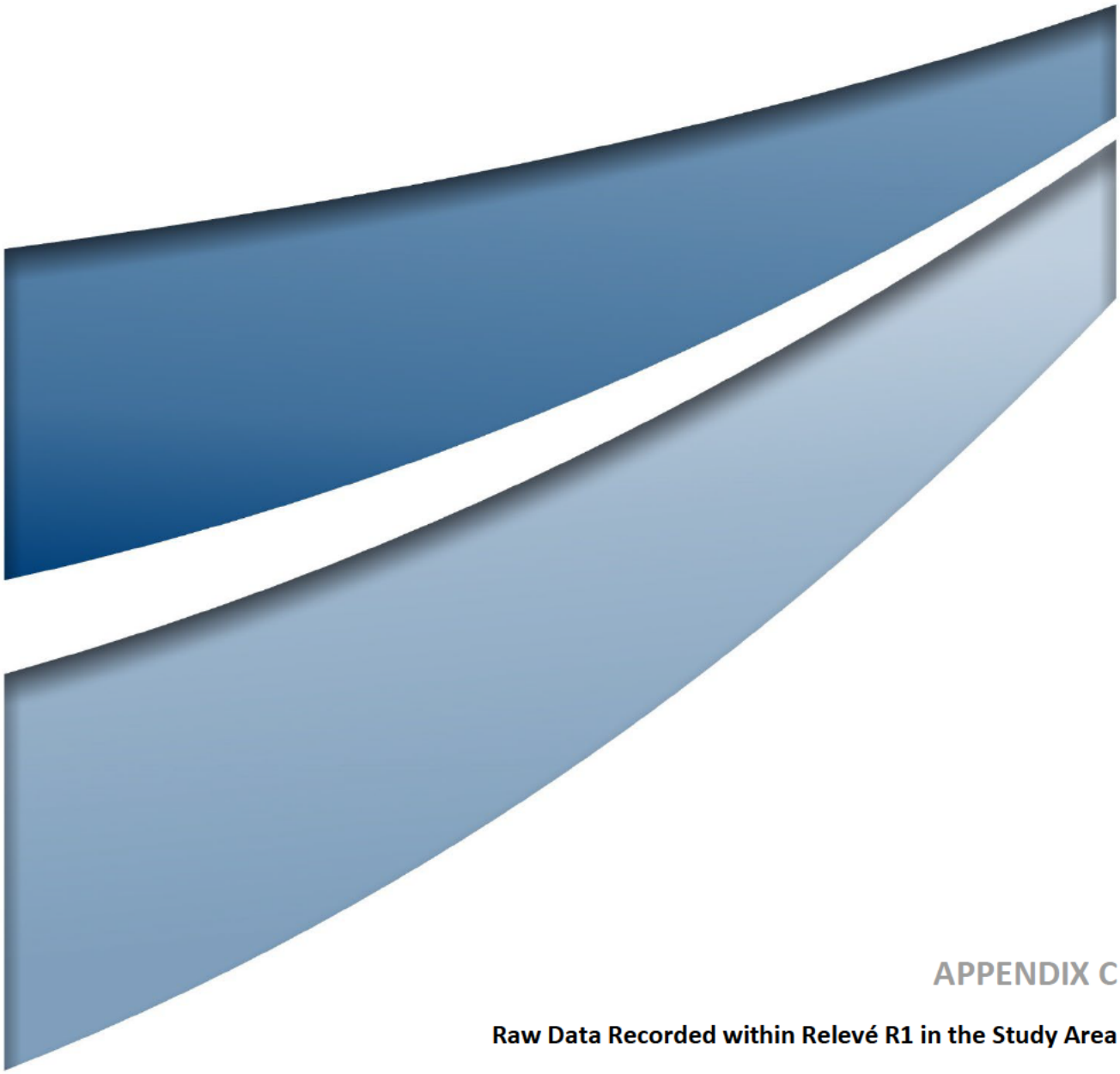
APPENDIX B

Vascular Plant Taxa Recorded in the Study Area

Note: introduced flora taxa denoted by *

Family	Taxon
Anarthriaceae	*Lyginia barbata*
	Lyginia imberbis
Arecaceae	**Washingtonia filifera*
Asparagaceae	*Lomandra caespitosa*
	Lomandra nigricans
	Lomandra preissii
Asteraceae	**Hypochaeris glabra*
Cactaceae	**Opuntia stricta*
Casuarinaceae	*Allocasuarina fraseriana*
	**Casuarina glauca*
Cyperaceae	*Chaetospora curvifolia*
	Schoenoplectus tabernaemontani
Dasypogonaceae	*Dasypogon bromeliifolius*
Dilleniaceae	*Hibbertia hypericoides*
Droseraceae	*Drosera erythrorhiza*
Ericaceae	*Styphelia conostephioides*
Euphorbiaceae	**Euphorbia terracina*
	**Ricinus communis*
Fabaceae	*Acacia cochlearis*
	Acacia pulchella
	Bossiaea eriocarpa
	Gompholobium tomentosum
	Hovea trisperma
	Jacksonia floribunda
	**Lupinus cosentinii*
Geraniaceae	**Pelargonium capitatum*
Haemodoraceae	*Conostylis aurea*
	Conostylis juncea
	Phlebocarya ciliata
	Phlebocarya filifolia
Haloragaceae	*Gonocarpus pithyoides*
Hemerocallidaceae	*Arnocrinum preissii*
Iridaceae	**Gladiolus caryophyllaceus*
	Patersonia occidentalis
Loranthaceae	*Nuytsia floribunda*
Myrtaceae	*Agonis flexuosa*
	Calothamnus quadrifidus
	Calytrix fraseri
	Chamelaucium uncinatum

Family	Taxon
Myrtaceae cont.	*Corymbia calophylla*
	Eremaea pauciflora
	Eucalyptus camaldulensis
	Hypocalymma suave
	**Leptospermum laevigatum*
	Melaleuca huegelii
	Melaleuca nesophila
	Melaleuca rhaphiophylla
	Melaleuca seriata
	Melaleuca teretifolia
	Pericalymma ellipticum
	Scholtzia involucrata
Oxalidaceae	**Oxalis pes-caprae*
Poaceae	*Amphipogon turbinatus*
	Austrostipa elegantissima
	**Cenchrus setaceus*
	**Cortaderia selloana*
	**Ehrharta calycina*
	**Eragrostis curvula*
	**Hyparrhenia hirta*
Proteaceae	*Adenanthos cygnorum*
	Banksia attenuata
	Banksia littoralis
	Banksia menziesii
	Grevillea thelemanniana (T – planted)
	Hakea prostrata
	Stirlingia latifolia
Restionaceae	*Alexgeorgea nitens*
	Cytogonidium leptocarpoides
	Desmocladus flexuosus
Rutaceae	*Cyanothamnus ramosus* subsp. *anethifolius*
Typhaceae	*Typha ?domingensis*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia fraseri*



APPENDIX C

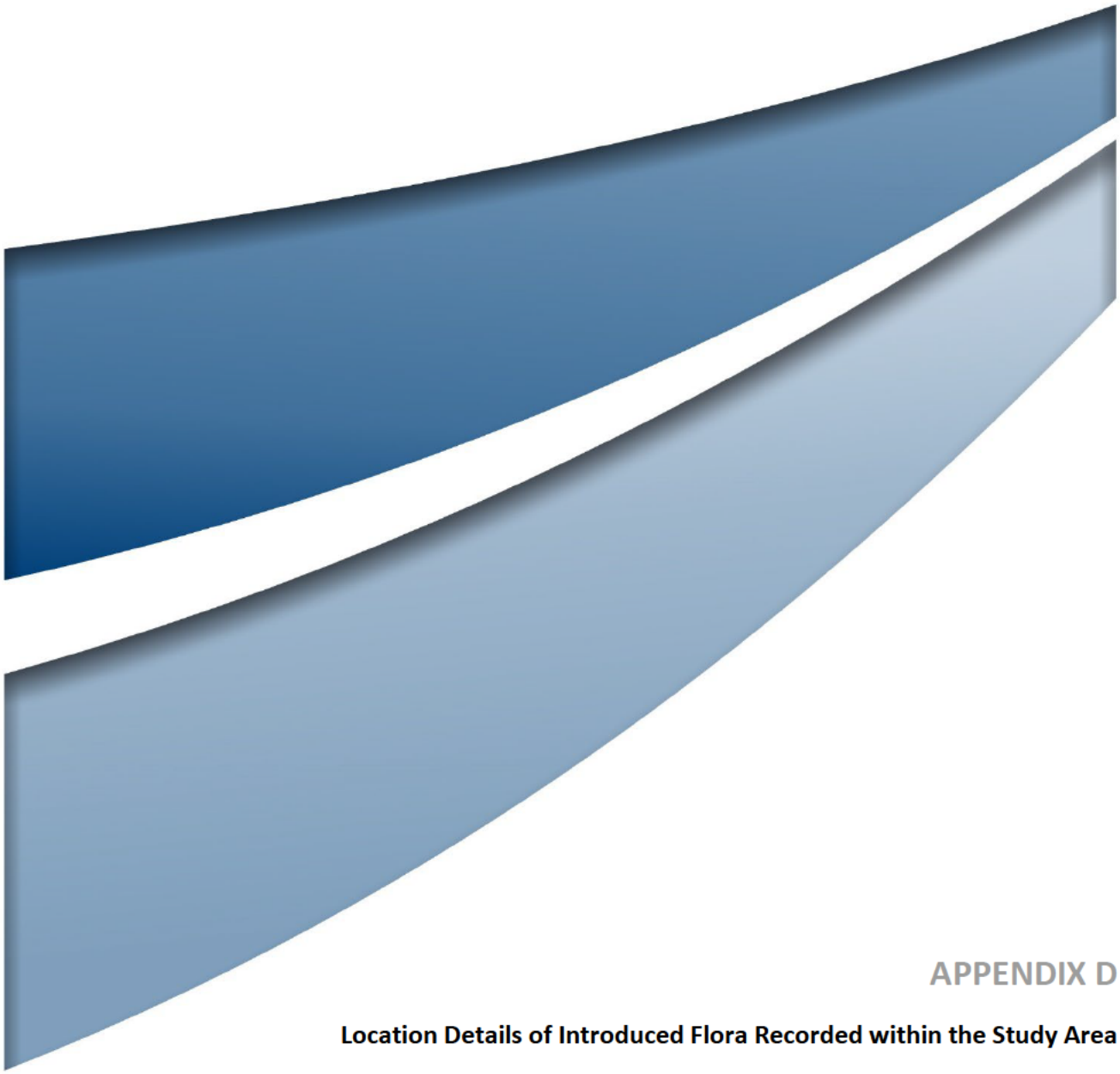
Raw Data Recorded within Relevé R1 in the Study Area

Site Name:	R1
Site Type:	RELEVE
Survey Date:	13/06/2023
GPS Location:	GDA94 Zone 50 403531E 6461388N
Landform Type:	Undulating Plain
Slope Class:	Gently Inclined (3 degrees)
Aspect:	E
Soil Type:	Sand
Soil Colour:	Grey
Rock Outcrop:	No bedrock exposed
Vegetation Condition:	Southern Vegetation Condition - 3 – Very Good
Fire:	>5yrs

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella	1.5	0.2
Alexgeorgea nitens	0.1	0.2
Amphipogon turbinatus	0.2	0.1
Arnocrinum preissii		
Austrostipa elegantissima	0.6	0.1
Banksia menziesii	5	4
Bossiaea eriocarpa	0.2	0.1
Calytrix fraseri		
Chaetospora curvifolia	0.2	0.1
Conostylis aurea	0.2	0.1
Conostylis juncea	0.2	0.1
Cyanothamnus ramosus subsp. *anethifolius*	0.3	0.1
Desmocladus flexuosus	0.2	0.1
Drosera erythrorhiza	0.1	0.1
**Ehrharta calycina*	0.5	3
Eremaea pauciflora	0.8	10
**Euphorbia terracina*	0.3	0.1
**Gladiolus caryophyllaceus*	0.5	0.2
Gompholobium tomentosum		
Hibbertia hypericoides	0.6	3
Hovea trisperma		
**Hypochaeris glabra*	0.1	0.3
Jacksonia floribunda	1.3	0.1
**Leptospermum laevigatum*	1.2	0.3
Lomandra caespitosa	0.2	0.1
Lomandra preissii		
Lyginia barbata	0.3	0.1
Lyginia imberbis	0.4	2
Macrozamia fraseri	1.5	0.1
Melaleuca seriata	1.5	0.2
Nuytsia floribunda	5	1
Patersonia occidentalis	0.3	0.2
Phlebocarya filifolia		
Scholtzia involucrata	0.4	0.2
Stirlingia latifolia	1	0.4
Styphelia conostephioides	0.4	1
Xanthorrhoea preissii	1.5	0.3

PHOTO

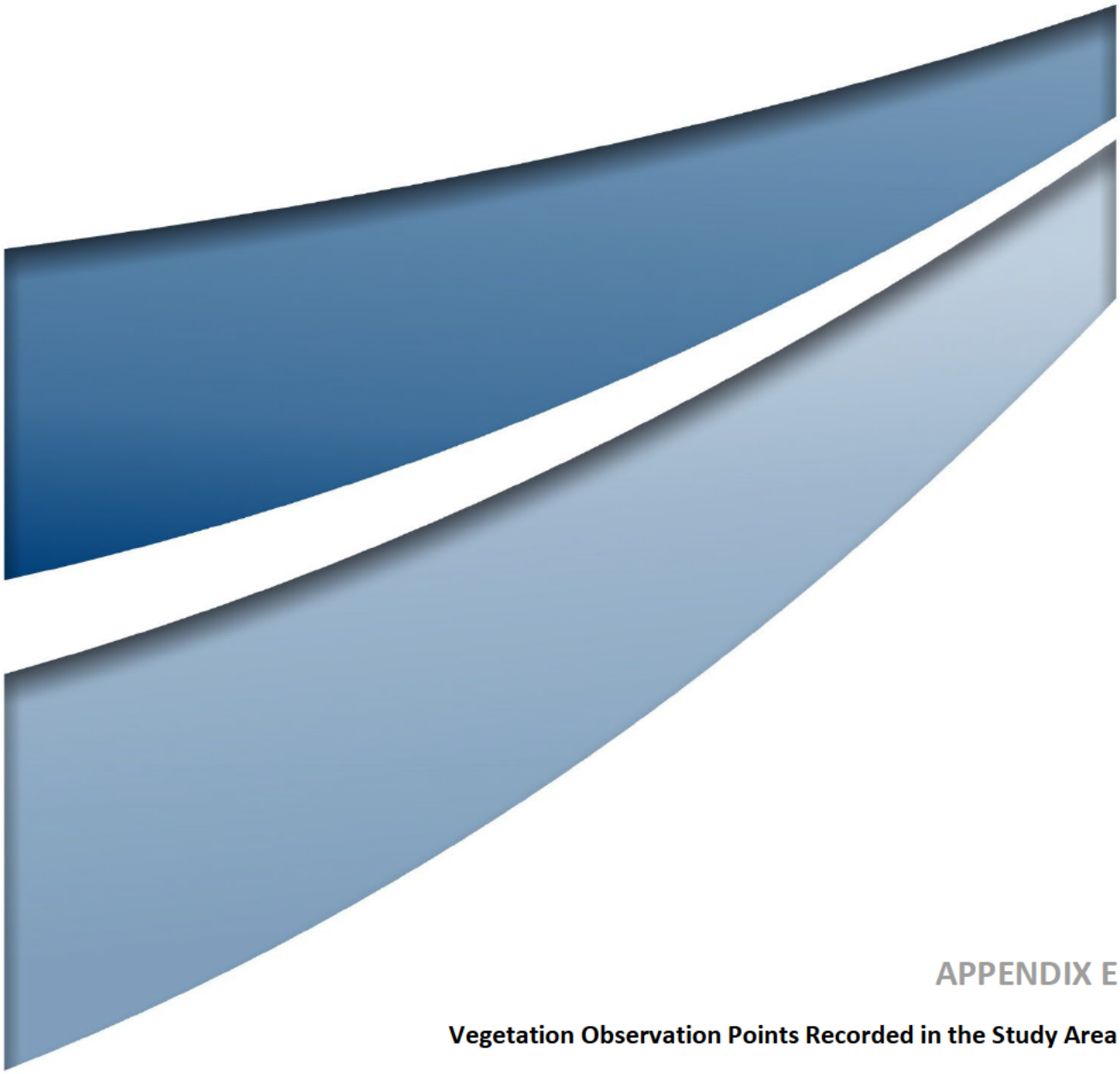


APPENDIX D

Location Details of Introduced Flora Recorded within the Study Area

Note: all locations are in GDA2020 Zone 50

Taxon	Easting	Northing	Location
Casuarina glauca	403320	6461101	VOP6
Cenchrus setaceus	403424	6461167	VOP7
Cortaderia selloana	403424	6461167	VOP7
Ehrharta calycina	403531	6461388	R1
Ehrharta calycina	403261	6461483	VOP2
Eragrostis curvula	403261	6461483	VOP2
Eragrostis curvula	403212	6461371	VOP5
Euphorbia terracina	403531	6461388	R1
Euphorbia terracina	403424	6461167	VOP7
Euphorbia terracina	403320	6461101	VOP6
Gladiolus caryophyllaceus	403531	6461388	R1
Hyparrhenia hirta	403320	6461101	VOP6
Hyparrhenia hirta	403424	6461167	VOP7
Hypochaeris glabra	403531	6461388	R1
Leptospermum laevigatum	403563	6461358	VOP4
Leptospermum laevigatum	403212	6461371	VOP5
Leptospermum laevigatum	403531	6461388	R1
Lupinus cosentinii	403261	6461483	VOP2
Opuntia stricta	403191	6461381	Opportunistic
Oxalis pes-caprae	403320	6461101	VOP6
Oxalis pes-caprae	403212	6461371	VOP12
Oxalis pes-caprae	403261	6461483	VOP2
Pelargonium capitatum	403320	6461101	VOP6
Ricinus communis	403320	6461101	VOP6
Washingtonia filifera	403424	6461167	VOP7

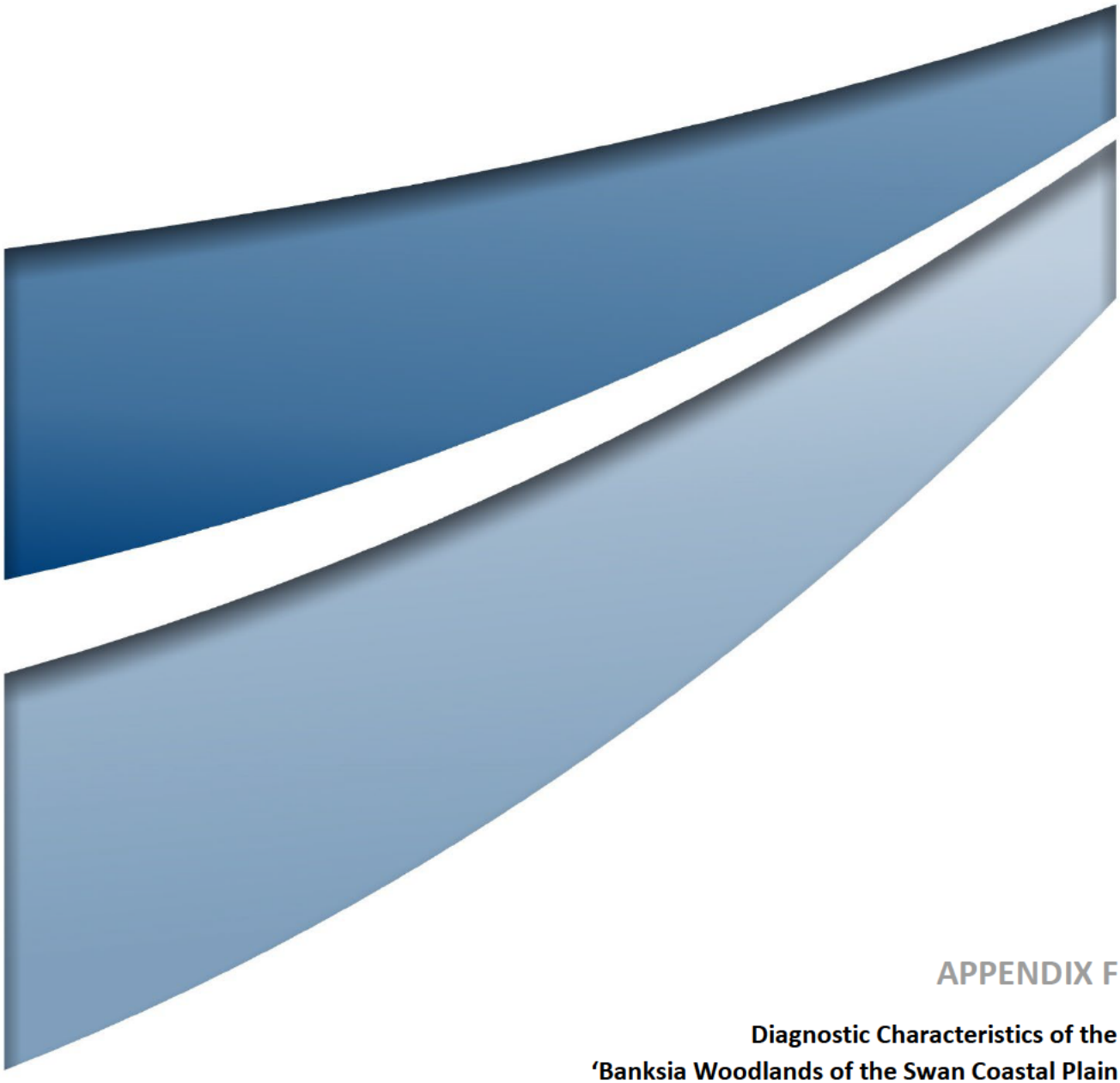


APPENDIX E

Vegetation Observation Points Recorded in the Study Area

Note: all locations are in GDA2020 Zone 50

Site	Easting	Northing	Comment
VOP1	403525	6461414	Transitional community - transitions into dampland vegetation. Approx 5 m band on north side of block/3 m band on south side of block. Vegetation condition is Good. Common taxa include *Corymbia calophylla, Dasypogon bromeliifolius, Cytogonidium leptocarpoides, Gonocarpus pithyoides, Hypocalymma suave, Lomandra nigricans, Pericalymma ellipticum* and *Phlebocarya ciliata*.
VOP2	403168	6461540	Some potential remnant trees and planted trees / shrubs over weeds. Remnant isolated *Banksia menziesii* and *Corymbia calophylla* trees present. Vegetation condition is Completely Degraded. Other taxa present include *Acacia cochlearis, Adenanthos cygnorum, Agonis flexuosa, Chamelaucium uncinatum, *Ehrharta calycina, *Eragrostis curvula, Hakea prostrata, *Lupinus cosentinii, Melaleuca nesophila* and **Oxalis pes-caprae*.
VOP3	403469	6461399	Embankment area of revegetation. Vegetation condition is Completely Degraded. Taxa present include planted *Acacia cochlearis, Adenanthos cygnorum, Banksia attenuata, Banksia menziesii, Grevillea thelemanniana* (T – planted), *Melaleuca huegelii* and introduced weeds.
VOP4	403563	6461358	Cleared area with drain in centre surrounded by revegetation. Vegetation condition is Completely Degraded. Taxa present include planted *Acacia cochlearis, *Leptospermum laevigatum, Melaleuca huegelii, Melaleuca rhaphiophylla* and *Melaleuca teretifolia*.
VOP5	403212	6461371	Planted trees and shrubs. Vegetation condition is Completely Degraded. Taxa present include *Calothamnus quadrifidus, Corymbia calophylla, Grevillea thelemanniana* (T – planted), *Melaleuca nesophila* and introduced weeds including **Eragrostis curvula, *Leptospermum laevigatum, *Opuntia stricta* (1 plant) and **Oxalis pes-caprae*.
VOP6	403320	6461101	Drain area surrounded by planted/colonised trees. No remnant vegetation present. Vegetation condition is Completely Degraded. Taxa present include *Casuarina glauca, Eucalyptus camaldulensis, *Euphorbia terracina, *Hyparrhenia hirta, Melaleuca nesophila, *Oxalis pes-caprae, *Pelargonium capitatum, *Ricinus communis, Schoenoplectus tabernaemontani* and *Typha ?domingensis*.
VOP7	403424	6461167	Swamp/drain in centre surrounded by planted/colonised trees and shrubs. Vegetation condition is Completely Degraded. Taxa present include *Allocasuarina fraseriana, Banksia littoralis, Calothamnus quadrifidus, *Cenchrus setaceus, *Cortaderia selloana, Eucalyptus camaldulensis, *Euphorbia terracina, *Hyparrhenia hirta, Melaleuca rhaphiophylla, Typha ?domingensis* and **Washingtonia filifera*.



APPENDIX F

Diagnostic Characteristics of the 'Banksia Woodlands of the Swan Coastal Plain ecological community' EPBC-listed TEC

Criterion		Description
Location and Physical Environment (must satisfy criterion 1)		
1		Patch is located within the Swan Coastal Plain IBRA Bioregion
Soils and Landform (must satisfy criterion 2(a) OR 2(b))		
2	(a)	Patch occurs on well-drained, low nutrient soils on sandplain landforms OR
	(b)	Patch occurs on sandy colluvium and aeolian sands of the Dandaragan Plateau
Structure and Vegetation (must satisfy criteria 3(a) AND 3(b), sometimes also satisfying criteria 3(c) and 3(d))		
3	(a)	Is a low woodland to forest AND
	(b)	Patch includes at least one of the following Banksia species as dominant or co-dominant in the upper layer: *Banksia attenuata, Banksia menziesii, Banksia prionotes, Banksia ilicifolia*
	(c)	Patch includes emergent trees of medium or tall (> 10 m) height above the Banksia canopy, often including: *Corymbia calophylla, Eucalyptus marginata, Eucalyptus gomphocephala, Nuytsia floribunda, Allocasuarina fraseriana, Callitris arenaria, Callitris pyramidalis, Xylomelum occidentale*
	(d)	Patch has an often highly species-rich understorey that consists of: • a layer of sclerophyllous shrubs of various heights • a herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses
Vegetation Condition (must satisfy criterion 4(a) OR 4(b))		
4	(a)	Vegetation condition of patch is Pristine to Good using the following indicative measures: • Low native species diversity to native species diversity fully retained • 10 % to 50 % weed cover OR
	(b)	Vegetation condition of patch is Degraded to Very Degraded but retains important natural values
Patch Size (must satisfy criterion 5(a) OR 5(b))		
5	(a)	Patch size meets the minimum size according to its condition, as below: • Pristine – no minimum patch size applies • Excellent – 0.5 ha or 5,000 m^2 (e.g. 50 m x 100 m) • Very Good – 1 ha or 10,000 m^2 (e.g. 100 m x 100 m) • Good – 2 ha or 20,000 m^2 (e.g. 200 m x 100 m) OR
	(b)	Patch is smaller than the above requirements but contributes to the overall function of the ecological community (e.g. contributes ß-diversity and connectivity)

Contra-indicators	Description
1	Patch is clearly dominated by *Banksia littoralis* (indicates a different, dampland community)
2	Patch is clearly dominated by *Bankia burdettii* (indicates a tall shrubland and not the Banksia Woodlands ecological community)
3	Patch represents FCT 20c (corresponds with a separate EPBC ecological community listing, 'Shrublands and Woodlands of the eastern Swan Coastal Plain', which occurs mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain)

Key

Colour	Definition
	Must be satisfied
	May or may not be satisfied
	Must not be satisfied

Source: Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (DoEE, 2016).

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