FLORA AND VEGETATION ASSESSMENT

DUNCRAIG SENIOR HIGH SCHOOL

COTERRA ENVIRONMENT

MAY 2022

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EXECUTIVE SUMMARY

Coterra Environment (Coterra) have been working with the Department of Education and Architecture Studio to facilitate approvals to expand the Duncraig Senior High School (SHS) campus, including obtaining a Native Vegetation Clearing Permit (NVCP).

Focused Vision Consulting Pty Ltd (FVC) was commissioned by Coterra to undertake a flora and vegetation assessment of the study area where clearing may be required, in order to determine the flora and vegetation values that may be affected by the potential development of the site.

The scope of work involved a single-phase spring detailed flora and vegetation assessment with associated reporting and data delivery, to support a NVCP application.

The scope of work required to be fulfilled was as follows:

- Undertake a desktop assessment for relevant Threatened and Priority flora and Threatened and Priority Ecological Communities (TECs and PECs) within the study area.
- Undertake a field assessment within the study area for flora and vegetation values (with an emphasis on Commonwealth listed TECs).
- Prepare a technical report that presents the desktop and field assessment findings and is suitable to assist in the preparation of approvals documentation for both State and Commonwealth regulatory authorities.

A single phase, detailed flora and vegetation field assessment was carried out in the study area during spring 2021 by experienced botanists on 10 November 2021.

The key findings and conclusions arising from the flora and vegetation assessment within the study area:

- No Threatened flora listed under the *Biodiversity Conservation Act 2016* (BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded.
- One Priority 4 flora species, *Jacksonia sericea,* as listed by the Department of Biodiversity, Conservation and Attractions (DBCA) was recorded.
- No weeds listed as Weeds of National Significance (WoNS) or Declared Pest (DP) plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) were recorded.
- Nine vegetation units were defined and mapped within the study area, which comprised of four intact vegetation units and five highly modified or planted units.
- Although vegetation that was determined to be characteristic of the Commonwealth listed Tuart (*Eucalyptus gomphocephala)* woodlands and forests of the Swan Coastal Plain (Tuart woodlands and forests TEC) and *Banksia* dominated woodlands of the Swan Coastal Plain IBRA Region (Banksia woodlands TEC) is present within the study area, neither are of adequate quality and size to meet condition thresholds and render them are eligible for inclusion as part of either nationally protected TEC and in conclusion, none of the defined vegetation units are considered to be representative of any State or Commonwealth listed TEC or PEC.
- The remaining extent of the single vegetation association and vegetation complex present within the study area falls below the 10% retention target in the context of the City of Joondalup, although the extent does exceed 30% for the Swan Coastal Plan, Perth IBRA sub-region and Western Australia.
- Vegetation units BaAh and CcXp are considered to be of regional significance, due to supporting populations of *Jacksonia sericea* (P4). This species is widely distributed on the Swan Coastal Plain between Wanneroo and Mandurah.
- The vegetation of the study area is not considered to be of significance due to other factors relevant to the assessment of vegetation significance.

1 INTRODUCTION

1.1 BACKGROUND

Coterra Environment (Coterra) have been working with the Department of Education and Architecture Studio to progress a Native Vegetation Clearing Permit (NVCP) application for the Duncraig Senior High School (SHS) campus in order to clear an area of remnant bushland on the school's property. The study area retains some native vegetation but is largely degraded, partially cleared and dissected by tracks and roads.

Focused Vision Consulting Pty Ltd (FVC) was commissioned by Coterra to undertake a flora and vegetation assessment of the study area in order to determine the flora and vegetation values that may be affected by the potential development of the site.

1.2 LOCATION

The study area is located within the Duncraig SHS campus, which is approximately 16 km north of the Perth CBD in the City of Joondalup and is bounded by Gilbert and Sullivan Roads in Duncraig. The potential development site encompasses two separate areas of vegetation that extend over approximately 2.15 ha (**Figure 1**).

1.3 SCOPE OF WORK

The scope of work involved a single-phase spring detailed flora and vegetation assessment with associated reporting (all in accordance with EPA 2016a) and data delivery (in accordance with the protocols of the Index of Biodiversity Surveys for Assessment (IBSA)) to support a NVCP application.

The scope of work required to be fulfilled was as follows:

- Undertake a desktop assessment for relevant Threatened and Priority flora and Threatened and Priority Ecological Communities (TECs and PECs) within the study area.
- Undertake a field assessment within the study area for flora and vegetation values (with an emphasis on Commonwealth listed TECs).
- Prepare a technical report that presents the desktop and field assessment findings and is suitable to assist in the preparation of approvals documentation for both State and Commonwealth regulatory authorities.

0 50 100 150 200 250 m

GDA 94 / MGA Zone 50

Legend

Study Area

Figure 1 - Study Area

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2 LEGISLATIVE CONTEXT

The flora and vegetation assessments were conducted in accordance with the following legislation:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act).

The assessments complied with requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2008) *Guidance Statement No. 33: Environmental Guidance for Planning and Development*
- EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*
- EPA (2016b) *Environmental Factor Guideline – Flora and Vegetation*.

Survey methodology guidance was also taken from:

- Commonwealth of Australia (2013) *Survey Guidelines for Australia's Threatened Orchids*.

2.1 THREATENED AND PRIORITY FLORA

The Department of Biodiversity, Conservation and Attractions (DBCA) assigns conservation status to endemic plant species that are geographically restricted to few known populations or threatened by local processes. Allocating conservation status to plant species assists in protecting populations and conserving species from potential threats (DBCA 2019).

The BC Act provides a statutory basis for the listing of threatened ecological communities (TECs), threatened and specially protected species, critical habitat and key threatening processes (DBCA 2021a). Whilst not awarded any statutory protection, the DBCA maintains the Priority flora list, for species of conservation concern. Therefore, both Threatened and Priority flora are important focuses of flora and vegetation surveys and their definitions are presented in **Table 1**.

Table 1 - Definitions of Threatened and Priority Flora Species (DBCA 2019)

Conservation Code	Category
T	**Threatened Species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the BC Act. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
P1	**Priority 1 – Poorly Known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2 – Poorly Known Species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3 – Poorly Known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority 4 – Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Federal Minister for the Environment (Department of Agriculture, Water and the Environment (DAWE) 2021a).

Species at risk of extinction are recognised as Threatened at a Commonwealth level and are categorised according to the EPBC Act as summarised in **Table 2**.

Table 2 - Categories of EPBC Act Threatened Flora Species

Conservation Code	Category
EX	**Extinct** Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	**Extinct in the Wild** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
CR	**Critically Endangered** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Any species listed in State and Commonwealth legislation as being of conservation significance is broadly considered to be a significant species. This incorporates species that are endangered, vulnerable and rare or covered by international conventions. Significance is not limited to species covered by State and Commonwealth legislation that also includes species of local significance and species showing significant range extensions or at the edge of their known range.

2.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat, which are subject to processes that threaten to destroy or significantly modify the assemblage across its range (DEC 2007).

The Minister may list an ecological community as a TEC in one of the following categories: Presumed Totally Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). A publicly available database, listing TECs within Western Australia (WA) is maintained by DBCA.

TECs in WA are protected under the State BC Act and some are also protected under the Commonwealth EPBC Act. The TECs on the Commonwealth register are also listed on the DAWE website, and in the Protected Matters Database (DAWE 2021a, 2021b).

Additional to TECs, ecological communities that are considered to be potentially of conservation significance (and potentially TECs) that do not currently meet survey criteria or that are not adequately defined, are rare but not threatened, have been recently removed from the TEC list or require regular monitoring, are considered to be Priority Ecological Communities (PECs) (DEC 2013) and are also required to be taken into consideration during environmental impact assessments (EPA 2016b).

2.3 VEGETATION OF SIGNIFICANCE

Alongside and in addition to significance according to statutory listings, vegetation may be considered significant at a National, State, regional or local level. Whilst not applicable to statutory protection, vegetation significance is an important consideration in the environmental impact assessment process.

2.3.1 Nationally Significant Vegetation

Vegetation communities may be considered to be of National significance where they support the following Commonwealth listed Matters of National Environmental Significance (MNES):

- Populations of Threatened (EPBC listed) species
- TECs listed as nationally (EPBC) significant
- RAMSAR Wetlands of International Importance (DAWE 2021a).

2.3.2 State Significant Vegetation

Vegetation communities may be considered to be of State significance where they:

- Support State listed Threatened flora, fauna and TECs afforded protection under the BC Act (EPA 2008, WALGA 2004)
- Occur within the State-managed conservation estate (areas protected under the *Conservation and Land Management Act 1984*) or areas that have been formally recommended by DBCA for inclusion in the State conservation estate (EPA 2008).

2.3.3 Regionally Significant Vegetation

Vegetation communities may be considered to be of regional significance where they:

- Support populations of Priority Flora or ecological communities (EPA 2016b, Government of Western Australia 2000)
- Are formally protected or recognised as Environmentally Sensitive Areas (ESAs), or under planning schemes for conservation, such as Bush Forever (EPA 2008, WALGA 2004)
- Support conservation category wetlands including associated vegetation (Government of Western Australia 2000)
- Maintain important ecological processes (EPA 2016b)
- Contain flora species exhibiting range extensions and undescribed species (EPA 2016b)
- Have a restricted regional distribution (EPA 2016b)
- Are represented by less than 30% of their pre-European extent (Commonwealth of Australia 2001).

2.3.4 Locally Significant Vegetation

Vegetation communities may be considered to be locally significant where they:

- Occur as small, isolated communities (Government of Western Australia 2000, WALGA 2004)
- Have a restricted local extent (proportion) (EPA 2016b) and/or are locally restricted to only one or a few locations (WALGA 2004).

2.4 VEGETATION CLEARING, EXTENT AND STATUS

Clearing of native vegetation is regulated in WA under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Any clearing of native vegetation is an offence, unless carried out under a clearing permit or if the clearing is for an exempt purpose (Department of Water and Environmental Regulation (DWER 2018). A clearing permit may be required under Part V of the EP Act, whereby permit applications to clear native vegetation must be assessed against the '10 Clearing Principles' as outlined in the regulations (DER 2014).

Where clearing of native vegetation is proposed to occur, there are several key criteria applied to the assessment of clearing permit applications, in the interests of biodiversity conservation (DER 2014).

The objective of the EPA in relation to flora and vegetation is 'to protect flora and vegetation so that biological diversity and ecological integrity are maintained' (EPA 2016a). This objective is documented in the EPA Factor Guideline - Flora and Vegetation (EPA 2016a). The EPA considers it is important that ecological communities are maintained above the threshold level of 30% of the original pre-clearing extent of the community in unconstrained areas and 10% within 'constrained' areas (EPA 2008).

2.5 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (ESAs) are areas that require special protection due to aspects such as landscape, fauna or historical value and are generally considered to be areas of high conservation value. ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

There are several types of ESAs relating to flora and vegetation, declared under Part V of the EP Act, which include:

- a defined wetland and the area within 50 m of that wetland
- the area covered by vegetation within 50 m of rare (Threatened) flora, to the extent where the vegetation is continuous with the vegetation in which the rare (Threatened) flora is located
- the area covered by a TEC
- Bush Forever sites.

2.6 INTRODUCED FLORA

Over 1,200 introduced (weed) species have been recognised to occur within Western Australia (EPA 2007). Weeds are plants that are not indigenous to an area and have been introduced either directly or indirectly through human activity. They establish in natural ecosystems and adversely modify natural processes, have the potential to dominate and simplify the ecosystems and thus decrease habitat value provided for native fauna. Weeds pose a threat to many native flora species due to their ability to rapidly grow and out-compete for available water, space, sunlight, and nutrients (EPA 2007).

2.6.1 Weeds of National Significance

Under the National Weed Strategy, there are currently 32 weed species listed as Weeds of National Significance (WoNS) (DAWE 2021c). Each weed listed was considered for inclusion based on the following criteria:

- invasive tendencies
- impacts
- potential for spread
- socioeconomic and environmental values.

2.6.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests, including pest plants, under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Department of Primary Industries and Regional Development (DPIRD 2021)). Under the BAM Act, Declared Pests are listed under one of the following categories:

- **C1 (exclusion)**, that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- **C2 (eradication)**, that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- **C3 (management)**, that applies to plants that should have some form of management applied that will alleviate the harmful impacts of the plant, reduce the numbers or distribution of the plant, or prevent or contain the spread of the plant (DPIRD 2017).

2.6.3 Environmental Weeds

Introduced species have also been ranked by a number of attributes, including invasiveness, distribution and environmental impacts in the various regions in the *Environmental Weed Strategy* (Department of Conservation and Land Management (CALM) 1999). To advance the above categorisation, the Invasive Plant Prioritisation Process for DBCA was developed in 2008 (DPAW) 2013).

3 EXISTING ENVIRONMENT

3.1 CLIMATE

The Perth Region has a temperate Mediterranean climate which is characterised by mild dry, warm summers and moderate seasonality. Perth Metro (Site Number 009225) is one of the Bureau of Meteorology (BoM) meteorological recording stations, which is approximately 13.2 km from the study area and has been recording since 1993. The site has recorded an average annual rainfall of 892 mm and annual mean maximum temperatures ranging from 18.5°C in winter to 31.6°C in summer (BoM 2022) (**Figure 2**).

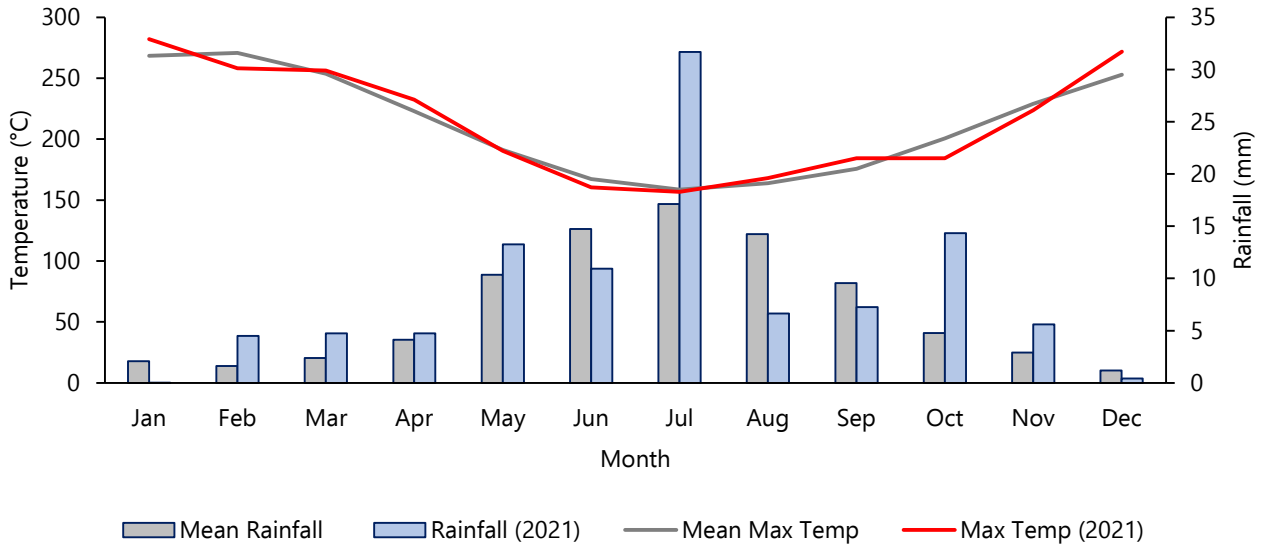

Figure 2 - Climate Data for Perth Metro Weather Station (009225) (BoM 2022)

3.2 IBRA REGION

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (DAWE 2021d). The study area lies within the Swan Coastal Plain (SWA) IBRA region and, at a finer scale, within the Perth subregion (SWA2; Mitchell *et al.* 2002).

The Swan Coastal Plain bioregion is a low lying coastal plain, mainly covered with Banksia and Tuart *(Eucalyptus gomphocephala)* woodlands on sandy soils. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone, as well as heath and/or tuart woodlands on limestone, banksia and jarrah *(Eucalyptus marginata)* -banksia woodlands on Quaternary marine dunes of various ages, marri *(Corymbia calophylla)* on colluvial and alluvials (Mitchell *et al.* 2002).

3.3 SOILS

The Swan Coastal Plain supports five major geomorphological systems (landforms) that lie parallel to the coast. From west to east these are; Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward and McArthur 1980; Gibson *et al.* 1994). The study area is situated on the Karrakatta Sand Yellow Phase (Ky) on the Spearwood Dunes System (DAWA 2001) and is summarised in **Table 3**. The spatial extent of the system is presented in **Figure 3**.

Table 3 - Summary of Soil Systems within the Study Area (Schoknecht *et al.* 2004)

System	Soil Unit	Description
Spearwood System	211Sp	Swan Coastal Plain from Dunsborough to Jurien. Sand dunes and sandplains with yellow deep sands, pale deep sands and yellow/brown shallow sands.

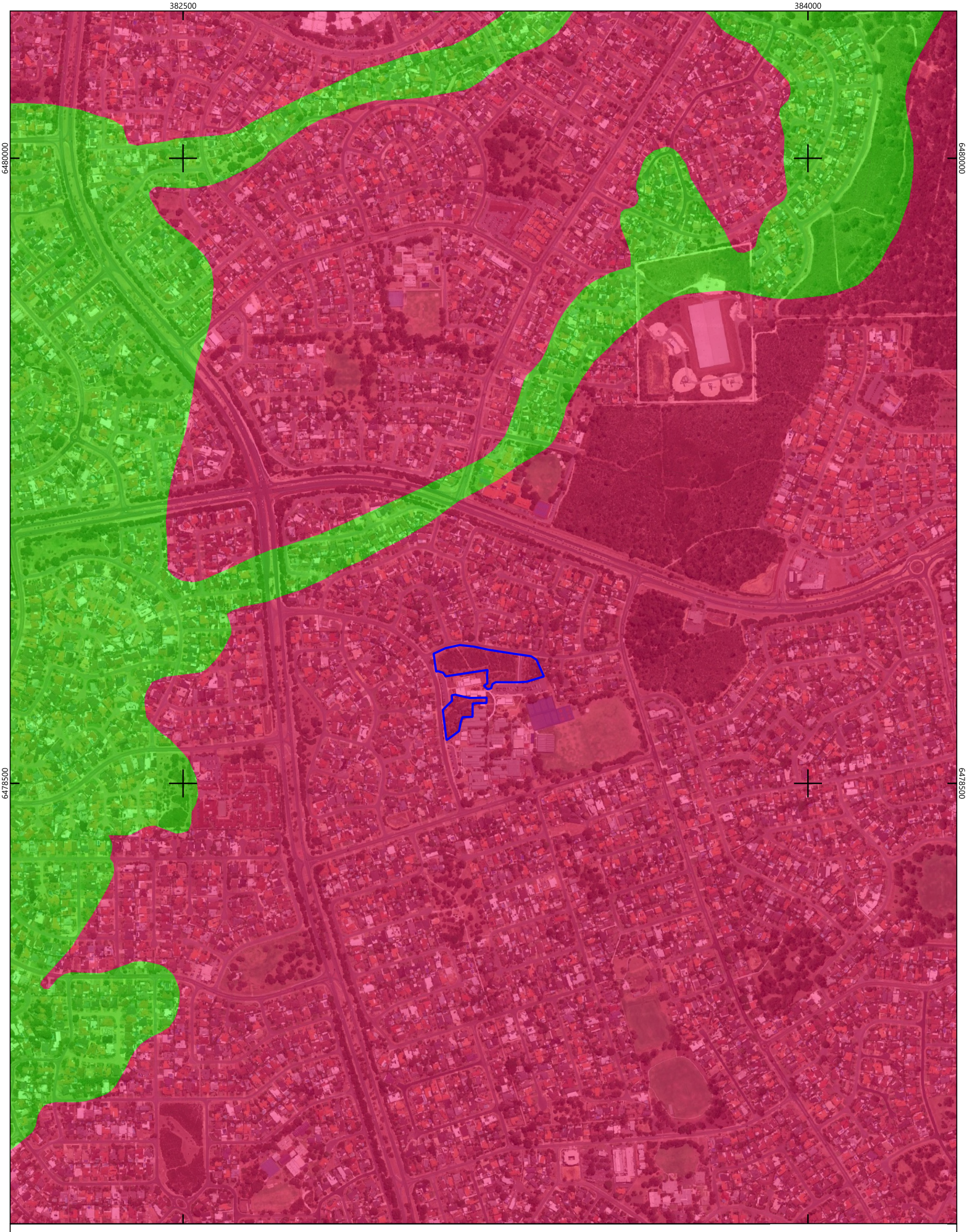

Figure 3 - Soils

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3.4 VEGETATION

The study area is located on the Swan Coastal Plain and has been broadly characterised by Beard (1990). The Beard vegetation associations supported by the study area and the remaining extent across a range of contexts are presented in **Table 4** and spatially in **Figure 4**.

Table 4 - Pre-European Vegetation of the Study Area (Beard 1990, DBCA 2018)

Extent Context	Veg. Association No.	Broad Vegetation Description	Pre–European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	% Current Extent in DBCA Managed Lands
Western Australia	998	Medium woodland; tuart	51,015.33	18,492.63	36.25	17.65
Swan Coastal Plain IBRA Region	998	Medium woodland; tuart	50,867.50	18,492.32	36.35	17.70
Perth IBRA Subregion	998	Medium woodland; tuart	50,867.50	18,492.32	36.35	17.70
City of Joondalup	998	Medium woodland; tuart	2,841.13	273.43	9.62	0.60

Vegetation complexes within the study area have also been defined by Heddle *et al.* (1980) and are based on vegetation in association with landforms and underlying geology. One vegetation complex, Cottesloe Complex – central and south, as described by Heddle *et al.* (1980) occurs within the study area, as described in **Table 5** and presented in **Figure 5**.

Table 5 –Vegetation Complexes Within the Study Area (Heddle *et al.* 1980)

Extent Context	Vegetation Complex	Description	Pre–European Extent (ha)	Current Extent (ha)	% Remaining
Swan Coastal Plain	Cottesloe Complex – Central and South	Mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri); closed heath on the Limestone outcrops.	45,299.61	14,567.87	32.16
City of Joondalup	Cottesloe Complex – Central and South	Mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri); closed heath on the Limestone outcrops.	3,975.87	298.21	7.50

Figure 4 - Pre-European Vegetation

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Figure 5 - Vegetation Complexes

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The objective of the Environmental Protection Authority (EPA) in relation to flora and vegetation is: *To protect flora and vegetation so that biological diversity and ecological integrity are maintained* (EPA 2016a). The EPA considers it is important that vegetation associations are maintained above a threshold level of 30% for unconstrained areas and 10% for constrained areas (which includes the Perth metropolitan area), of the original pre-clearing extent of each association (EPA 2008). A level of 30% pre-clearing extent is considered to be the level below which species loss appears to accelerate exponentially at the ecosystem level (EPA 2008).

The following key criteria are applied to vegetation clearing from a biodiversity perspective, which justifies the retention targets (EPA 2000):

- The 'threshold level' below which species loss appears to accelerate exponentially within an ecosystem level, is regarded as being at a level of 30% (of the pre-European, i.e. pre-1750 extent of the vegetation type).
- A level of 10% of the original extent of a vegetation community is regarded as being a level representing Endangered.
- Clearing which would increase the threat level to a vegetation community should be avoided.

The remaining extent of all of the Beard (1990) vegetation associations (**Table 4**) and Heddle *et al.* (1980) vegetation complexes (**Table 5**) within the City of Joondalup fall below the 10% constrained area threshold, but they all exceed the 30% threshold for the Swan Coastal Plan, Perth IBRA sub-region and Western Australia extents.

4 METHODOLOGY

4.1 DESKTOP REVIEW

4.1.1 Flora and Vegetation

The desktop assessment consisted of database searches for significant flora and ecological communities based on a central point within the study area (115° 45' 57'' E,31° 49' 16'' S) with a 1 km buffer (but a 5 km buffer for ecological communities), hereafter referred to as the desktop assessment area. Database searches included the DBCA Threatened and Priority flora records (DBCA 2021b), NatureMap (DBCA 2021c) (**Appendix A**), the Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) (DAWE 2021b) for Matters of National Environmental Significance (MNES) (**Appendix B**) and the DBCA Threatened and Priority ecological communities records (DBCA 2021d).

The database search results were compiled into a table that concluded the likelihood of occurrence of each of the significant species and communities based on habitat preferences of known recorded locations for each species. The likelihood of all significant flora occurring within the study area was assessed based on known records and their age (currency) and proximity to the study area, and the presence of suitable habitat within the study area. Based on this assessment, each species was given a likelihood of occurrence category of 'likely to occur', 'may occur' or 'unlikely to occur'. Where recent records and suitable species habitat occurs within or near the study area, these species were given a category of 'likely to occur', whilst species occurring a greater distance from the study area with limited suitable habitat, or for very old records, a category of 'unlikely to occur' or 'may occur' was applied, depending on record relevance.

4.2 FIELD ASSESSMENT

4.2.1 Flora and Vegetation

A single phase, detailed flora and vegetation field assessment was carried out in the study area during spring 2021 by Senior Botanists, Lisa Chappell and Catherine Krens, on 10 November 2021.

Flora and vegetation data were collected in the field at sampling points where vegetation was noted to be of differing floristic composition. Pegged quadrats were installed where native vegetation was found to be in 'Good' or better condition, in accordance with the requirements for flora and vegetation assessments as documented in EPA (2016a). Detailed data collection points (relevés) were recorded where vegetation was not in 'Good' or better condition.

To meet the EPA requirement, at least three quadrats per vegetation unit were established where vegetation was deemed to be in 'Good' or better condition, where possible.

A total of three quadrats were established in areas of 'Good' condition and five relevés were established in an area of poorer quality vegetation, as per the Technical Guidance (EPA 2016a). The locations of these are presented in **Figure 6**.

Sampled quadrats were demarcated with a peg (galvanised fence-dropper) at each corner and the north-west corner co-ordinates were recorded using GPS. During sampling, quadrats were marked by measuring tapes. Quadrat dimensions were 10 m x 10 m in accordance with the Technical Guidance (EPA 2016a) and in alignment with the Gibson *et al.* (1994) study, and the data collected were used to characterise all of the intact native vegetation communities (vegetation in 'Good' or better condition).

The following information was collected at each quadrat and relevé:

- observer
- date
- GPS location (MGA94)
- representative photograph
- soil type and colour
- topography
- vegetation condition/degradation/disturbances (e.g. grazing, weed invasion, fire)
- flora species observed, including average height and projected foliage cover of dominant species within each stratum
- vegetation community, described in accordance with Level 5 of the National Vegetation Information System (NVIS) (DEH 2003)
- vegetation condition, assessed against the currently accepted scale; an adaptation of the Keighery (1994) condition scale.

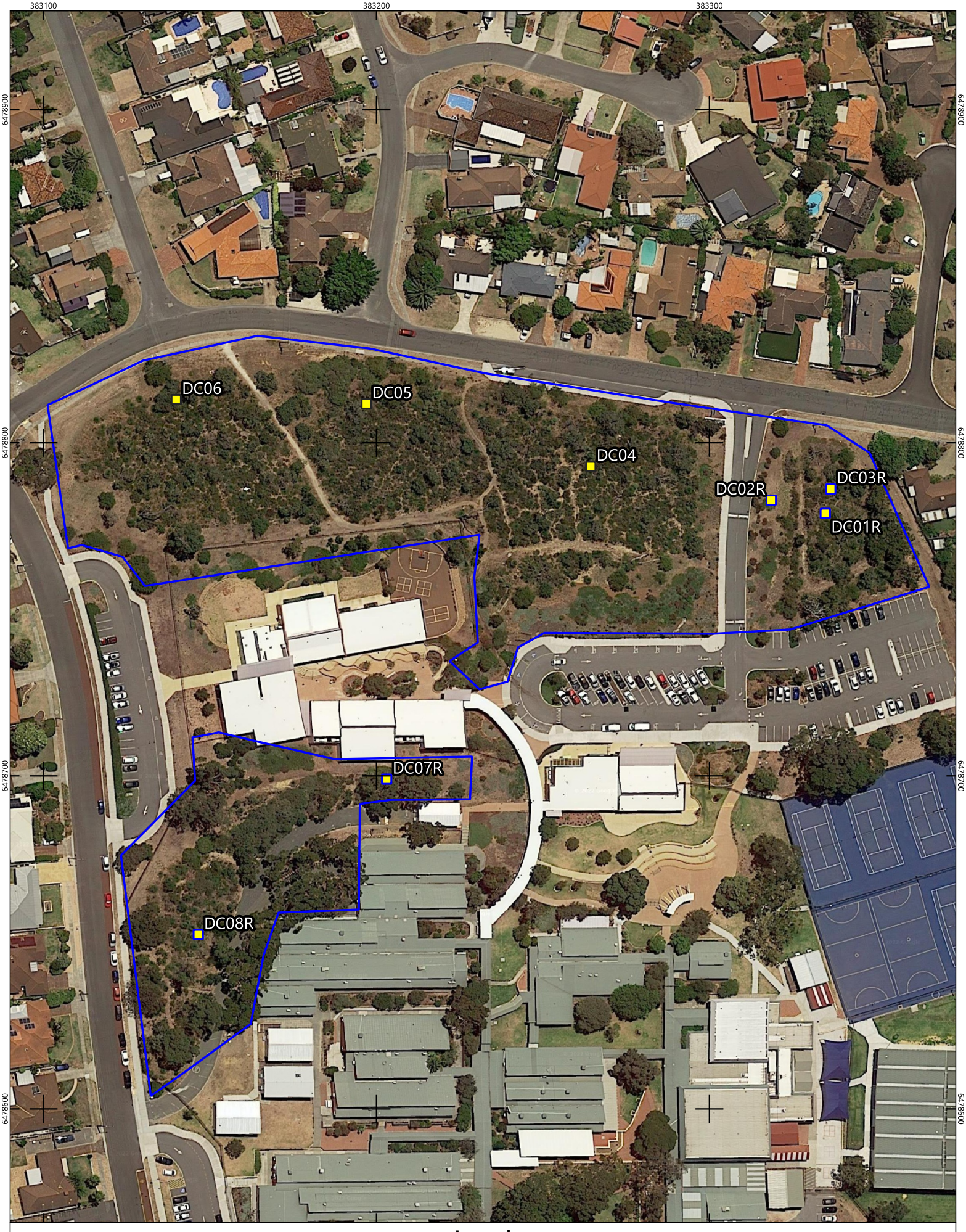
Observations and opportunistic data collection were also carried out during foot traverses within and throughout the study area and track logs of all personnel were captured using GPS-enabled devices to demonstrate survey effort. These combined track logs for the study area are presented in **Figure 7**.

The field assessment also included targeted searches for conservation significant flora potentially occurring in the study area, which were targeted during foot traverses. Selective targeted searching was also carried out whilst traversing between quadrats and relevés and in limited additional areas as appropriate, depending on flowering times and preferred habitats of target species. Any observed flora suspected to be Threatened or Priority was marked using GPS-enabled devices to enable inclusion in the report maps and spatial data layers.

The flora and vegetation data collected during assessment, from the combination of quadrats and continuous opportunistic observations, contributed to the flora inventory for the study area. The vegetation units of the study area have been defined by data collected within quadrats and relevés and opportunistically between, and how they relate to other environmental features such as soil type and landform. A map of the vegetation units was then developed using GIS and is presented in **Section 5.2.2**.

Vegetation condition was assessed using the current bushland condition scale, which is an adaptation of Keighery (1994) scale, as described in EPA (2016a).

All field data was recorded using electronic tablets equipped with the mobile mapping software, Mappt™ and customised data collection forms, tailored to the electronic collection of quadrat data and targeted flora surveys. Draft vegetation unit and condition mapping were also prepared in shapefiles directly into Mappt™ whilst in the field, and this formed the basis of the mapping presented in this report and provided in spatial data.



0 10 20 30 40 50 m

GDA 94 / MGA Zone 50

Legend

- Study Area
- Quadrat
- Relevé

Figure 6 - Quadrat and Relevé Locations

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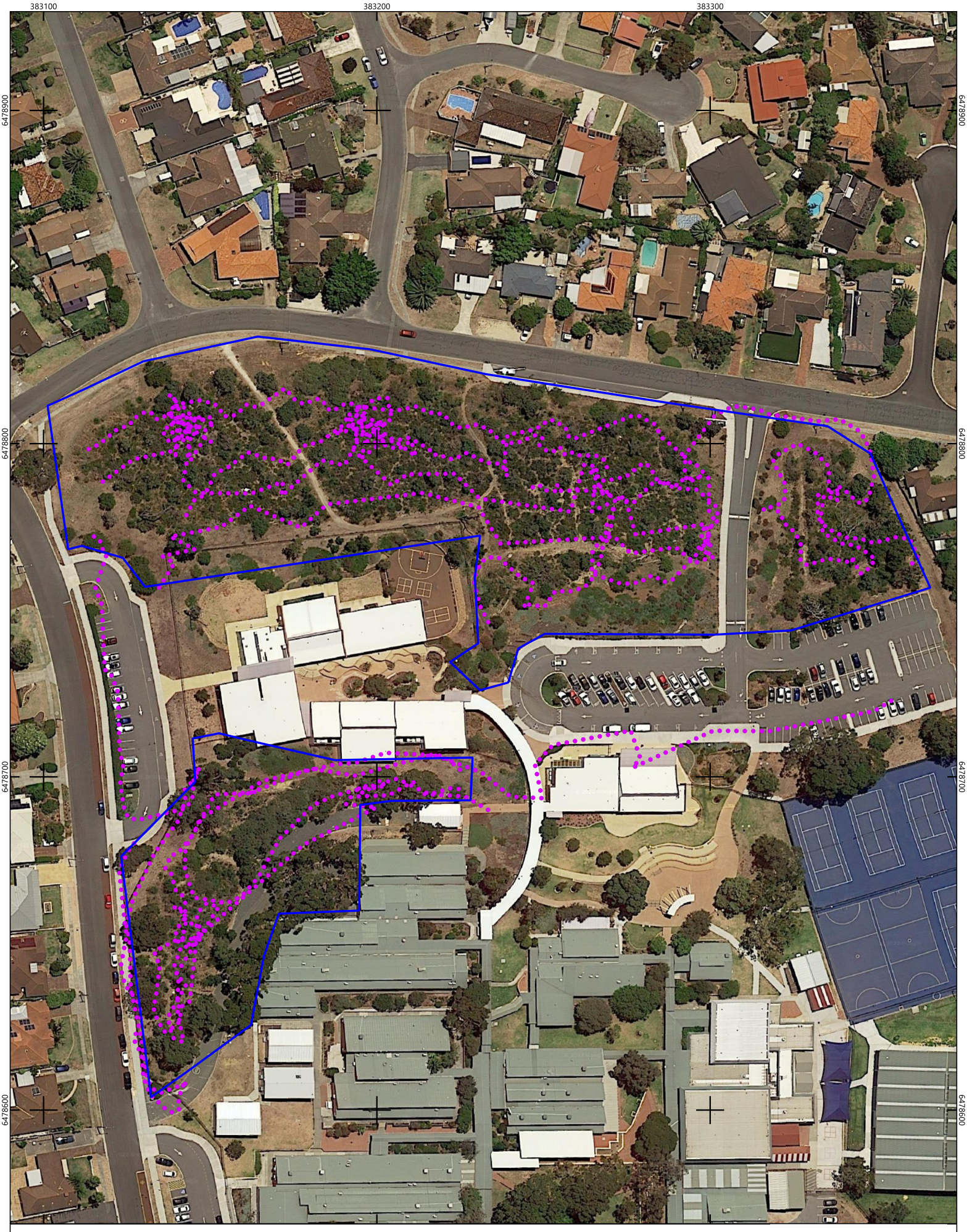

Figure 7 - Search Traverses

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4.3 SURVEY LIMITATIONS

The current assessment was assessed against limitations imposed by many variables as outlined in the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) and *Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment* (EPA 2016b) (**Table 6**).

Table 6 – Potential Survey Limitations and Constraints

Aspect	Constraint?	Commentary
Availability of regional data, previously available information	No	A wealth of data, literature and other information is available for sites within the Perth metropolitan area, such as the study area. DBCA database search results are evidence of the high volume of records that exist for the study area and surrounds.
Scope (detail)	No	A single-phase, detailed flora and vegetation assessment was carried out in accordance with EPA (2016a). The EPA Guidelines state that a minimum of three quadrats should be sampled in each vegetation unit considered to be of 'Good' or better condition. Three quadrats were sampled within vegetation in 'Good' or better condition and five relevé were sampled in an area of 'Degraded' or lower vegetation. This level of survey detail was more than adequate for the assessment of floristic values.
Competency/Experience of personnel	No	All of the personnel undertaking the field assessment, flora identifications, data analysis, vegetation mapping and reporting are experienced botanists, with specialist skills in their respective fields. All botanists have a minimum of 14 years' experience with a significant proportion of which have been on the Swan Coastal Plain.
Survey effort/detail/intensity	No	The single-phase, detailed flora and vegetation assessment was considered adequate to determine the floristic values within the study area. Three quadrats were sampled within vegetation in 'Good' or better condition and five relevés were sampled in an area of 'Degraded' or lower vegetation. All quadrats and relevés were sampled during November 2021.
Seasonal timing and climatic conditions	No	The flora and vegetation field assessments were conducted during the optimal spring season for biological surveys on the Swan Coastal Plain. Rainfall in the three months preceding the November field assessment (August, September and October) was below average during August and September and above average and near optimal during October (**Figure 2**). A total of 122.8 mm of rain was recorded during October 2021, well above the long-term mean (40.9 mm). The above average winter rainfall during the growth stage, would have promoted the production of new leaves and increase the number (and quality) of flowers and fruit (Chen *et al.* 2019).
Access	No	The entire study area was easily accessible on foot and was traversed in detail during November 2021.
Mapping reliability	No	The mapping has been prepared at a scale based on ground-truthed areas, with limited extrapolation given the good accessibility of the study area. Therefore, mapping reliability is considered high.
Disturbances	No	Numerous tracks bisect the study area, which have high foot traffic. The disturbances are considered to be a minor constraint for the survey. Due to the degraded condition of some sections of the study area, one of the vegetation units was only able to be sampled with three quadrats.
Survey completeness	No	Most areas were easily accessible and data and other information for the regional is abundant. The field surveys for the current study were all able to be completed for the entire study area and in thorough detail.

5 RESULTS

5.1 DESKTOP ASSESSMENT

5.1.1 Threatened and Priority Flora

The DBCA database search, NatureMap Species Report and the DAWE Protected Matters Search Tool conducted for the study area returned results for 17 species of Threatened and Priority flora that have the potential to occur within a 1 km radius of the study area **(Table 7)**.

The list of conservation significant species comprised seven Commonwealth and State-listed Threatened flora, three Priority 1, two Priority 2, four Priority 3 and one Priority 4 species. Of these, it was determined that eight species are considered unlikely to occur, seven species may occur, and two species considered likely to occur. The species that are considered likely to occur were not considered Commonwealth and State-listed Threatened flora.

Table 7 - Threatened and Priority Flora with the Potential to occur within the Study Area

Species	EPBC Act Conservation Status	BC Act/DBCA Conservation Status	Description	Preferred Habitat	Likelihood of Occurrence	Source of Record
Drakaea elastica	Endangered	Critically Endangered	Tuberous, perennial herb growing to 0.1-0.3 m high with a single bright green, glossy, prostrate heart-shaped leaf. Produces distinctive flower with red and green-yellow parts from October to November.	Bare patches of white or grey sandy soils. Low-lying situations adjoining winter-wet swamps.	Unlikely to occur - suitable habitat unlikely to occur. Specimen found approximately 43 km from study area.	PMST
Marianthus paralius	Endangered	Endangered	Prostrate, scrambling to climbing, woody shrub with twining stems. Produces red flowers from September to November.	White sandy soil over limestone. Limestone ridges, coastal cliffs and limestone outcropping.	May occur - suitable habitat may occur. Specimen found 7.8 km from study area.	DBCA
Diuris purdiei	Endangered	Endangered	Tuberous, perennial orchid growing to 0.15-0.45 m high. Produces distinct flattened yellow flowers with brown blotches on their underside from September to October.	Grey-black sand, sandy clay moist soils. Winter-wet swamps	Unlikely to occur - suitable habitat unlikely to occur.	PMST
Andersonia gracilis	Endangered	Vulnerable	Slender, erect or open straggly shrub growing to 0.1-0.5 m high. Produces pink to pale mauve flowers in ovoid oblong groups of 4-14 on terminal heads from September to November.	White-grey sand, sandy clay, gravelly loam soils. Winter wet areas, near swamps.	Unlikely to occur - suitable habitat unlikely to occur. Specimen found approximately 24 km from study area.	PMST
Eucalyptus argutifolia	Vulnerable	Vulnerable	Mallee with smooth grey to pale coppery bark growing to 2-4 m high. Produces white flowers from March to April.	Shallow grey sand soil over limestone. Limestone outcrops, ridges and breakaways.	Unlikely to occur - specimen found approximately 14 km from study area.	PMST
Diuris micrantha	Vulnerable	Vulnerable	Tuberous, perennial orchid growing to 0.3-0.6 m high with a basal tuft of narrow, linear leaves. Produces up to 7 yellow flowers with red-brown markings from August to October.	Brown/black sandy clay-loam and clayey soils. Winter-wet depressions and swamps, in shallow water.	Unlikely to occur - suitable habitat unlikely to occur.	PMST
Drakaea micrantha	Vulnerable	Vulnerable	Tuberous, perennial herb growing to 0.15-0.3 m high with a single silvery-grey, prostrate heart-shaped leaf. Produces distinct flower with red and yellow parts from September to October.	Bare patches of white-grey sandy soils. Winter wet swamps, disturbed areas.	Unlikely to occur - suitable habitat unlikely to occur. Specimen found approximately 29 km from study area.	PMST

Species	EPBC Act Conservation Status	BC Act/DBCA Conservation Status	Description	Preferred Habitat	Likelihood of Occurrence	Source of Record
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)		Priority 1	Compact shrub growing to 1.2 m high. Produces pink or pale pink to white flowers from September to December.	Grey, yellow sandy soil with limestone. Hills and outcrops.	May occur - suitable habitat may occur. Specimen found 2.9 km from study area.	DBCA
Leucopogon maritimus		Priority 1	Low, spreading shrub growing to 0.4 m high. Produces white flowers from March to October.	Sandy soil, often with limestone. Coastal areas, dunes and limestone outcrops.	May occur - suitable habitat may occur. Specimen found 5 km from study area.	DBCA
Grevillea sp. Ocean Reef (D. Pike Joon 4)		Priority 1	Erect, spreading shrub growing to 2 m high and 3 m wide. Flower colour unknown, known to flower in November. Restricted to Ocean Reef area.	Brown, grey sand. Dunes and swales.	May occur - suitable habitat may occur. Specimen found 7.5 km from study area.	DBCA
Acacia benthamii		Priority 2	Erect, spinose shrub growing to 1 m high. Produces golden-yellow flowers in globular heads on short stalks in leaf axils from August to September.	Brown, yellow, grey sandy soils. Flats and slopes, sometimes with limestone and wetlands.	Likely to occur - specimen found 941 m from study area.	DBCA
Thelymitra variegata		Priority 2	Tuberous, perennial herb growing to 0.1-0.35 m high. Produces conspicuous purple-red flowers with dark purple blotches and yellow parts from June to September.	Sandy clay or sandy soils. Associated with laterite	Unlikely to occur - suitable habitat unlikely to occur. Specimen found 8.6km from study area.	DBCA
Pimelea calcicola		Priority 3	Erect to spreading shrub growing to 0.2 to 1 m high. Produces white flowers with some pink from September to November.	Brown sandy loam, white-grey sandy soil associated with limestone. Coastal limestone ridges.	May occur - suitable habitat may occur. Specimen found 1.9 km from study area.	DBCA
Conostylis bracteata		Priority 3	Tufted, rhizomatous perennial grass like herb growing to 0.2-0.4 m high. Produces yellow flowers from August to November.	Sandy soil. Dunes, sometimes with limestone outcropping.	May occur - suitable habitat may occur. Specimen found 2.6 km from study area.	DBCA
Austrostipa mundula		Priority 3	Erect, fine perennial grass growing to 0.6 m high with mostly basal leaves. Produces brown flowers in a linear or elliptic panicle 5-12 cm long from September to November.	Grey sandy soil with limestone. Dune slopes, coastal cliffs, plains.	May occur - suitable habitat may occur. Specimen found 7.6 km from study area.	DBCA

Species	EPBC Act Conservation Status	BC Act/DBCA Conservation Status	Description	Preferred Habitat	Likelihood of Occurrence	Source of Record
Stylidium paludicola		Priority 3	Reed-like perennial herb growing to 0.35-1 m high. Produces pink flowers from October to December.	Peaty sand over clay soils. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Unlikely to occur - suitable habitat unlikely to occur. Specimen found 7.8 km from study area.	DBCA
Jacksonia sericea		Priority 4	Low spreading shrub growing to 0.6 m high. Produces flowers with yellow and red and orange parts usually from December to February.	Grey/white, yellow/brown sandy loam soils, often associated with limestone. Limestone ridges, slopes and flats.	Likely to occur - specimen found 957 m from study area.	DBCA

Figure 8 - Threatened and Priority Flora

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5.1.2 Threatened and Priority Ecological Communities

A review of DBCA's Threatened and Priority Ecological Communities (TEC and PEC) database and the EPBC Protected Matters Search Tool identified that five Ecological Communities occur within a 5 km buffer of the study area (DBCA 2021d) **(Table 8)**. Two of these communities, Tuart (*Eucalyptus gomphocephala)* woodlands and forests of the Swan Coastal Plain and *Banksia* dominated woodlands of the Swan Coastal Plain IBRA Region are both Commonwealth-listed TECs (**Table 8**).

Table 8 – Threatened and Priority Ecological Communities Occurring within a 5 km Buffer of the Study Area

Abbreviated Identifier	Community Name	Commonwealth Category	State Category
Tuart Woodlands	Tuart *(Eucalyptus gomphocephala)* woodlands and forests of the Swan Coastal Plain	Critically Endangered	Priority 3
Banksia WL SCP	Banksia dominated Woodlands of the Swan Coastal Plain IBRA Region	Endangered	Priority 3
SCP 30a	*Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain (floristic community type 30a as originally described in Gibson *et al.* (1994))		Vulnerable
SCP 24	Northern Spearwood Shrublands and Woodlands.		Priority 3
SCP29a	Coastal shrublands on shallow sands		Priority 4

5.1.2.1 Tuart Woodlands and Forests TEC

The Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain Ecological Community (Tuart woodlands and forests TEC) was approved for inclusion as an Endangered TEC under the EPBC Act on 4 July 2019. This ecological community occurs as woodland, forest or other structural forms associated with soils of the Swan Coastal Plain with a prominent tree layer of *Eucalyptus gomphocephala* (Tuart) as the defining feature (DEE 2019).

The Tuart woodlands and forests TEC occurs within the Swan Coastal Plain IBRA region within the Perth subregion, from Jurien, 200 km north of Perth, to Sabina River near Busselton, 225 km south of Perth (DEE 2019). The distribution of the ecological community is limited by the distribution of Tuart, although Tuart trees do also occur as a component of other vegetation communities, including the nationally listed Banksia woodlands TEC (DEE 2016).

Twelve Floristic Community Types (FCTs) described by Gibson *et al.* (1994) contain Tuart trees as a component of the TEC and these are summarised in **Table 9**.

Table 9 - Floristic Community Types Corresponding to the Tuart Woodlands and Forests TEC

FCT	FCT Name	WA TEC/PEC	EPBC TEC
Supergroup 2 – Seasonal Wetlands			
16	Highly saline seasonal wetlands		
17	*Melaleuca rhaphiophylla* - *Gahnia trifida* seasonal wetlands		
19b	Woodlands over sedgelands in Holocene dune swales		
Supergroup 3– Uplands centered on Bassendean Dunes			
21a	Central *Banksia attenuata* - *Eucalyptus marginata* woodlands		
Supergroup 4 - Uplands centered on Spearwood and Quindalup Dunes			
24	Northern Spearwood shrublands and woodlands	P3	
25	Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands	P3	
26b	Woodlands and mallees on Limestone		
28	Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands		
29a	Coastal shrublands on shallow sands	P3	
30b	Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	P3	
30c2	Woodlands and shrublands on Holocene dunes (re-allocated from 30a/30c (Gibson *et al.* 1994)		
S11	Northern *Acacia rostellifera* - *Melaleuca systena* shrublands		

5.1.2.2 Banksia Woodlands TEC

The *Banksia Woodlands of the Swan Coastal Plain IBRA region ecological community* (Banksia woodlands TEC) was approved for inclusion as an Endangered TEC under the EPBC Act on 16 September 2016. This ecological community occurs as a woodland associated with some soils of the Swan Coastal Plain with a prominent tree layer of Banksia with scattered Eucalypts and other tree species among or emerging above the canopy. The understorey is comprised of a species rich mix of sclerophyllous shrubs, graminoids and forbs. The Banksia woodlands TEC is largely restricted to the Swan Coastal Plain IBRA bioregion, within the Perth (SWA02) and Dandaragan (SWA01) sub-regions. It extends into the adjacent Jarrah Forrest IBRA region (JA01 and JA02 sub-regions) and areas of the Whicher and Darling escarpments where pockets of Banksia woodland may occur. This TEC mainly occurs on deep Bassendean and Spearwood sands or occasionally on Quindalup sands at the eastern edge (TSSC 2016).

Twenty-one Floristic Community Types (FCTs) described by Gibson *et al.* (1994), in Bush Forever (Government of Western Australia 2000), Keighery *et al.* (2012a) and Urban Bushland Council (2011) best correspond to the Banksia woodlands TEC (TSSC 2016) and these are summarised in **Table 10**.

Table 10 - Floristic Community Types Corresponding to the Banksia Woodlands TEC

FCT	FCT Name	WA TEC/PEC	EPBC TEC
Supergroup 3 – Uplands centered on Bassendean Dunes and Dandaragan Plateau			
20a	*Banksia attenuata* woodlands over species rich dense shrublands	Endangered	
20b	Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands	Endangered	
20c	Eastern shrublands and woodlands	Critically Endangered	Endangered
21a	Central *Banksia attenuata - Eucalyptus marginata* woodlands		
21b	Southern *Banksia attenuata* woodlands	P3	
21c	Low lying *Banksia attenuata* woodlands or shrublands	P3	
22	*Banksia ilicifolia* woodlands	P3	
23a	Central *Banksia attenuata - Banksia menziesii* woodlands		
23b	Northern *Banksia attenuata - Banksia menziesii* woodlands	P3	
23c	North-eastern *Banksia attenuata - Banksia menziesii* woodlands		
S09	*Banksia attenuata* woodlands over dense low shrublands		
Supergroup 4 – Uplands centered on Spearwood and Quindalup Dunes			
24	Northern Spearwood shrublands and woodlands	P3	
25	Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands	P3	
28	Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands		
Whicher Scarp FCTs (Keighery *et al.* 2012)			
A1	Central Whicher Scarp Mountain Marri Woodland WHSFCT_A1	P1	
A2	North Whicher Scarp Jarrah and Woody Pear woodland WHSFCT_A2		
A3	North Whicher Scarp *Banksia* and Woody Pear woodland WHSFCT_A3		
A4	Whicher Scarp *Banksia grandis*, Jarrah and Marri woodland WHSFCT_A4		
B1	Swan Coastal Plain/North Whicher Scarp *Banksia attenuata* woodland WHSFCT_B1		
B2	West Whicher Scarp *Banksia attenuata* woodland WHSFCT_B2		
C2	Whicher Scarp Jarrah woodland on deep coloured sands WHSFCT_C2		

5.1.2.3 SCP 30a – Rottnest Island Pine (*Callitris preissii*) and Tea Tree (*Melaleuca lanceolata)* TEC

The Rottnest Island Pine and Tea Tree TEC is listed as 'Vulnerable' under State legislation and is described as a woodland and forest community dominated by *Callitris preissii*, *Melaleuca lanceolata*, *Spyridium globulosum*, *Acanthocarpus preissii*, *Rhagodia baccata*, *Austrostipa flavescens* and *Trachymene pilosa* (Gibson *et al.* 1994). The critical habitat for the Rottnest Island Pine and Tea Tree TEC includes the dunes and swale habitat on which they occur, the fresh superficial groundwater that is likely to provide water to the trees in the community, and the catchment for this groundwater (DPAW 2014).

5.1.2.4 SCP 24 – Northern Spearwood Shrublands and Woodlands

The Northern Spearwood shrublands and woodlands (SCP 24) is defined as heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra (Banksia) sessilis, Calothamnus quadrifidus* and *Schoenus grandiflorus* (TSSC 2016). Other species typical for this community are *Lepidosperma*

angustatum, *Desmocladus flexuosus, Melaleuca acerosa (systena), Xanthorrhoea preissii, Phyllanthus calycinus, Dianella revoulta, Conostylis aculeata* and *Lomandra maritima* (Gibson *et al.* 1994).

5.1.2.5 SCP 29a – Coastal Shrublands on Shallow Sands

SCP 29a (Coastal Shrublands on Shallow Sands) supports shrublands on shallow sands over limestone, in close proximity to the coast, on the southern Swan Coastal Plain. Landforms are dunes from Supergroup 4; uplands centred on Spearwood and Quindalup Dunes (Gibson *et al.* 1994).

5.2 FIELD ASSESSMENT

5.2.1 Flora

A total of 76 flora species, from 64 genera and 31 families was recorded during the field survey. The dominant families were found to be Fabaceae (14 taxa), Poaceae (8 taxa species) and Proteaceae (8 taxa). The total includes 57 (75%) native species and 19 (25%) introduced (weed) species. The full list of vascular flora species recorded within each vegetation unit (which includes opportunistic species records, additional to flora species recorded within quadrats and relevés) is presented in **Appendix C** and individual quadrat and relevé data is presented in **Appendix D**.

No species listed as Threatened flora under the BC Act or under the EPBC Act were recorded. One Priority 4 species *Jacksonia sericea* was recorded from two locations within vegetation units BaAh and CcXp (**Figure 9**).

None of the recorded flora are exhibiting an extension beyond their currently documented range, in accordance with records of the Western Australian Herbarium (WAH 1998-).

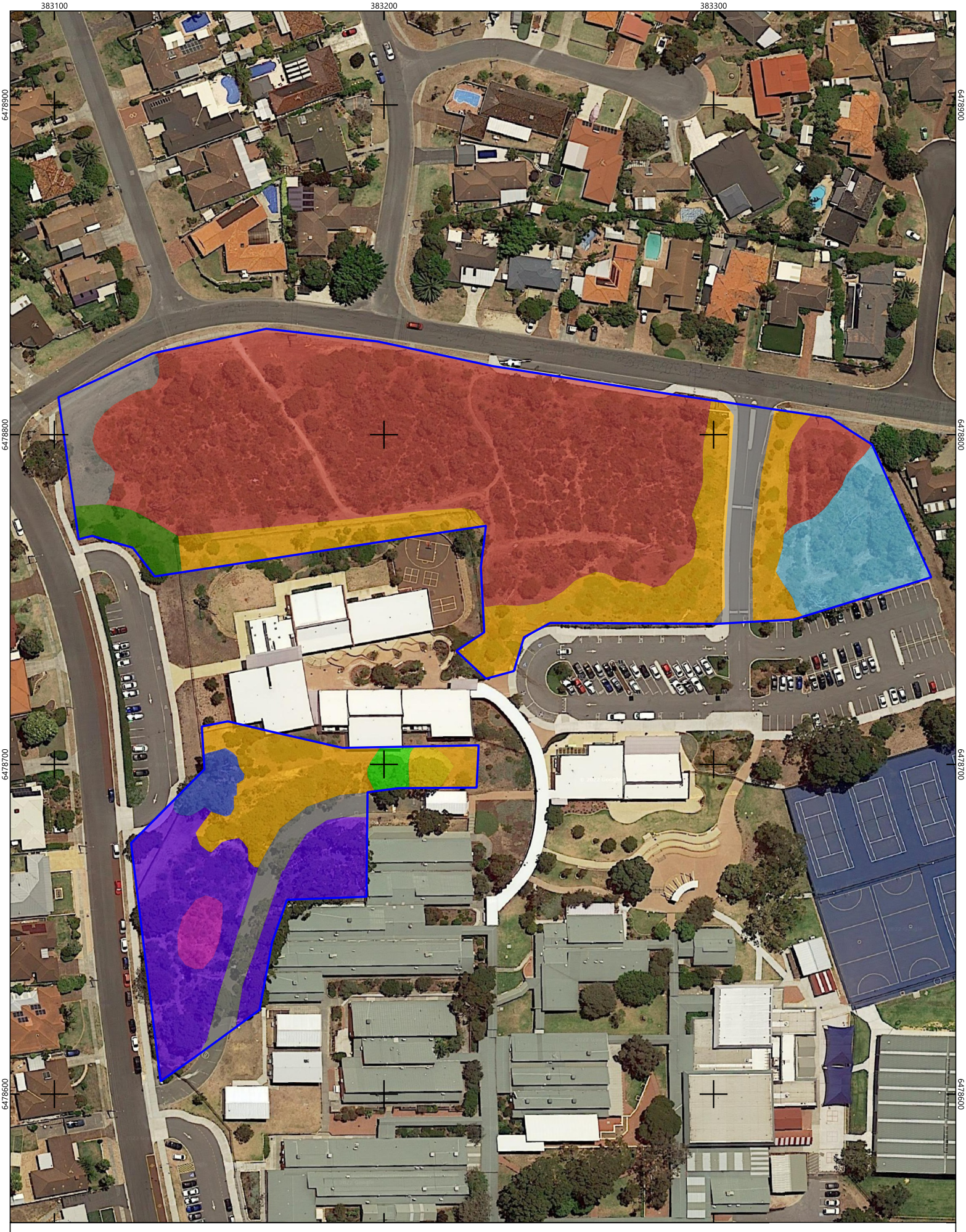
No taxa listed as Declared Pest [s22(2)] plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (DPIRD 2021) were recorded. In addition, none of the species recorded are listed as Weeds of National Significance (WoNS) (DAWE 2021c).

5.2.2 Vegetation

Nine vegetation units were defined and mapped within the study area as described in **Table 11** and presented spatially in **Figure 9**.

Table 11 - Summary of Recorded Vegetation Units in the Study Area

Vegetation Unit	Vegetation Description	Area (ha)	% of Study Area
BaAh Banksia Woodland	*Banksia attenuata* and *Banksia menziesii* Low Open Woodland over *Allocasuarina humilis* and *Calothamnus quadrifidus* Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland	1.057	49.163
CcBm Marri Woodland	*Corymbia calophylla* Woodland over *Banksia menziesii* Low Open Woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* Low Sparse Shrubland	0.015	0.698
CcXp Marri Woodland	*Corymbia calophylla* Low Open Woodland over *Xanthorrhoea preissii* Tall Sparse Shrubland over *Templetonia retusa* and *Melaleuca systena* Low Sparse Shrubland	0.023	1.070
EmXp Jarrah Woodland	*Eucalyptus marginata* Low Open Woodland *over Banksia attenuata* Woodland over *Acacia saligna* and *Xanthorrhoea preissii* Tall Open Shrubland over *Allocasuarina humilis* and *Hibbertia hypericoides* Low Sparse Shrubland	0.131	6.093
Cc Isolated Marris	Isolated *Corymbia calophylla* over weeds and introduced grasses	0.014	0.651
Eg Isolated Tuarts	Isolated *Eucalyptus gomphocephala* over weeds and introduced grasses	0.027	1.256
Esp Introduced Eucalypts	Non-endemic *Eucalyptus* spp. over introduced weeds and grasses	0.242	11.256
PA Planted Acacias	Planted *Acacia* spp. over weeds and introduced grasses	0.038	1.767
PS1 Planted Shrubland	Planted endemic and non-endemic species over weeds and introduced grasses	0.419	19.488
Cleared		0.184	8.558
	Total	**2.150**	**100**



0 10 20 30 40 50 m

GDA 94 / MGA Zone 50

Legend

- Study Area
- BaAh
- Cc
- CcBm
- CcXp
- Cleared
- Eg
- EmXp
- Esp
- PA
- PS1

Figure 9 - Vegetation Units

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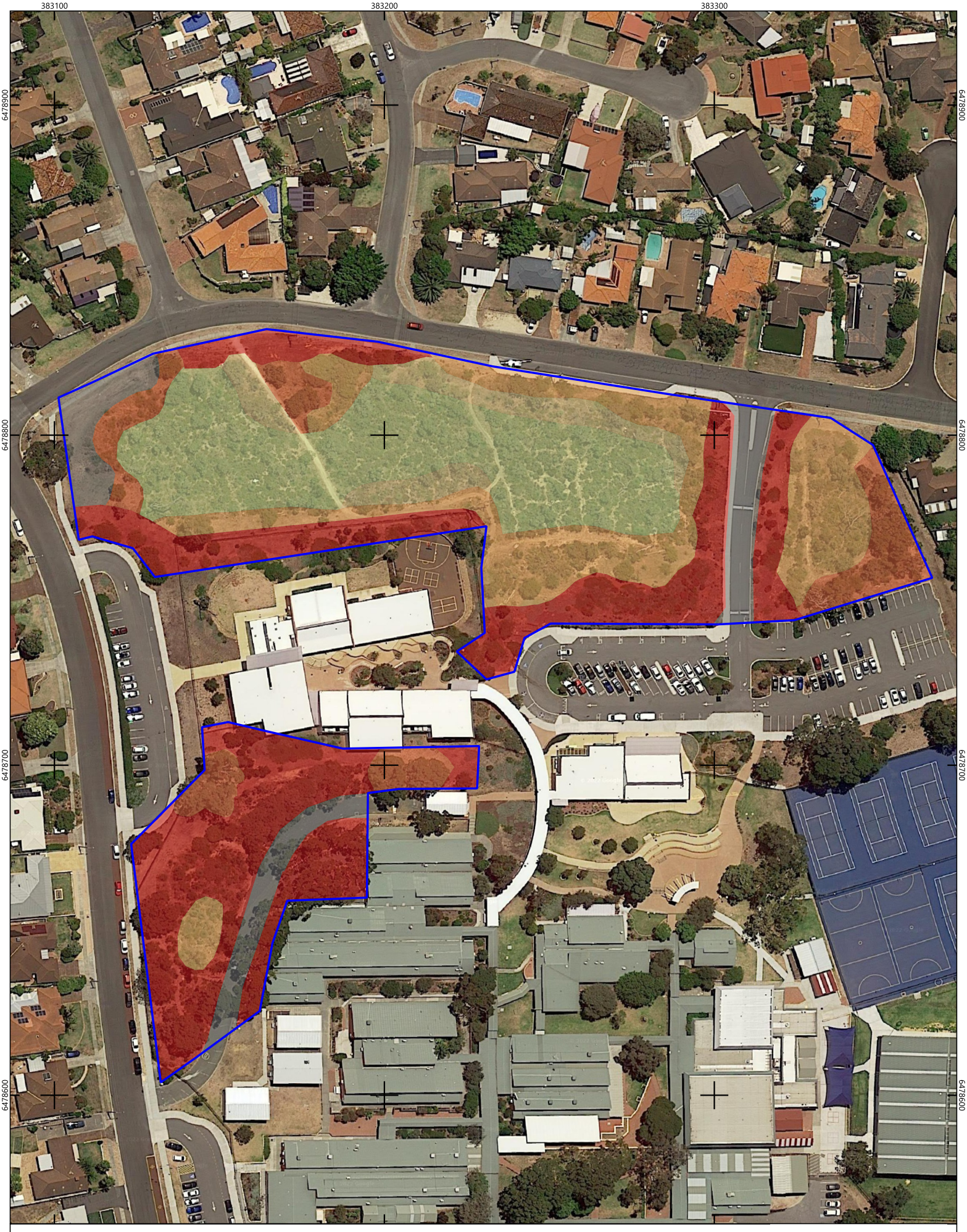
COT21009 06 April 2022

The condition of the vegetation within the study area was found to range from 'Good' to 'Completely Degraded'. The majority of the vegetation was observed to be in 'Completely Degraded' condition. The spatial extent of the varying vegetation condition is presented in **Figure 10**.

Table 12 – Summary of Vegetation Condition

Vegetation Condition Rating	Area (ha)	% of Survey Area
Good	0.489	22.744
Degraded-Good	0.123	5.721
Degraded	0.409	19.024
Completely Degraded-Degraded	0.194	9.023
Completely Degraded	0.751	34.940
Cleared	0.184	8.558
Total	**2.150**	**100**



0 10 20 30 40 50 m

GDA 94 / MGA Zone 50

Legend

- Study Area
- Completely Degraded
- Completely Degraded-Degraded
- Degraded
- Degraded-Good
- Good
- Cleared

Figure 10 - Vegetation Condition

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5.2.2.1 *Assessment of Floristic Community Types*

FCTs classify vegetation based on a combination of species composition, structure and the landforms on which they occur. The FCTs of the Swan Coastal Plain have been defined as part of a range of studies, with the main references for these being Gibson *et al.* (1994).

Floristic analysis of recorded quadrat data against the Gibson *et al.* (1994) datasets for FCTs via species presence/absence analysis and multivariate cluster analysis using the statistical analysis software, PATN™ was conducted in an attempt to assign FCTs to sampled vegetation quadrats within the mapped vegetation units (**Figure 11**). The results of this analysis suggest all quadrats within BaAh, show strongest affinity to FCT 28 Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands and FCT 23c North-eastern *Banksia attenuata* - *Banksia menziesii* woodlands. Neither of these individual FTCs are considered to be State or Commonwealth listed TECs, however they form part of the Commonwealth Endangered Banksia woodlands of the Swan Coastal Plain TEC.

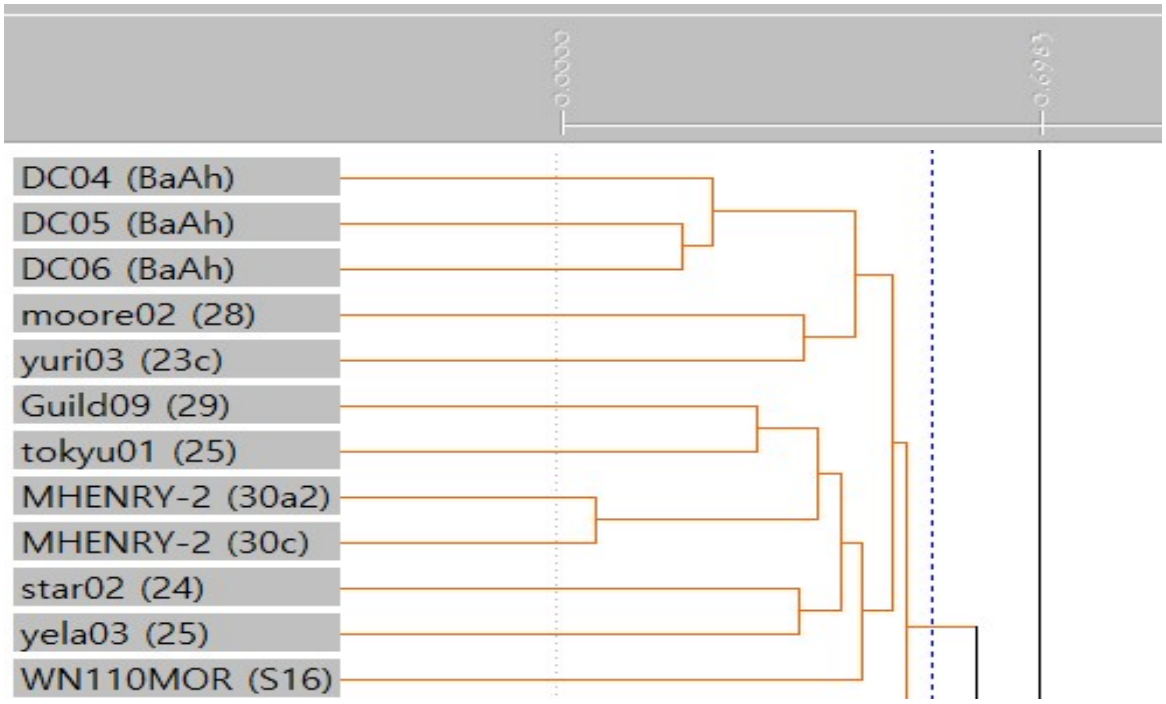

Figure 11 – Excerpt of Banksia Quadrat Cluster Analysis against Gibson *et al.* (1994)

5.2.3 Threatened and Priority Ecological Communities

The desktop assessment identified five TECs and/or PECs that are known to occur within the desktop assessment area. None of the TEC and PECs identified through the DBCA database search results have been previously recorded to intersect the study area. Of these, the field assessment identified the potential for the following two Commonwealth-listed TECs to potentially occur within the study area:

- *Tuart* (*Eucalyptus gomphocephala*) *woodlands and forests of the Swan Coastal Plain* ecological community' (Tuart woodlands and forests TEC) (Critically Endangered: EPBC Act, Priority 3 DBCA)
- *Banksia woodlands of the Swan Coastal Plain IBRA Region ecological community* (Banksia woodlands TEC) (Endangered: EPBC Act, Priority 3; DBCA).

These TECs and their occurrence or absence within the study area in the context of the assessment results are discussed in the following sections.

5.2.3.1 *Tuart Woodlands and Forests TEC*

DBCA records indicated that no Critically Endangered Tuart woodlands and forests TEC have been previously identified within the study area.

The primary defining feature of the Tuart woodlands and forests TEC is the presence of *Eucalyptus gomphocephala* (Tuart) in the uppermost canopy (DEE 2019). The ecological community intergrades and/or interacts with other ecological communities of the Swan Coastal Plain, including the Banksia woodlands TEC, where Tuart occurs as an occasional emergent above a stratum dominated or co-dominated by Banksia species *including Banksia attenuata, B. menziesii*, *B. prionotes* or *B. ilicifolia* (DEE 2019).

Tuart Woodlands and Forests Characterisation

One defined vegetation unit (Eg) was recorded on the western side of the study area which is a Tuart woodland. Vegetation unit Eg, which comprises isolated *Eucalyptus gomphocephala* (three trees) over weeds and introduced grasses) was characterised using a checklist developed based on the Conservation Advice (DEE 2019). The checklist includes the key characteristics of the TEC, including botanical region, soil and landform types and required or typical species for each stratum and the results of this analysis determined that vegetation unit Eg is characteristic of the Tuart woodlands and forests TEC (**Table 13**).

Table 13 - Tuart Woodlands and Forests TEC Characterisation

Key Characters			Present?
Key Character (see key)	a)	Swan Coastal Plain bioregion	+
	b)	Soils and landform either Spearwood or Quindalup dune systems, occasionally occurring on Bassendean dunes and Pinjarra plains	+
	c)	Contains a minimum of two *Eucalyptus gomphocephala* (Tuart) situated within 60 m of each tree's canopies	+
	d)	Occurs as woodland but can occur as forest, open forest, open woodland and various mallee forms	+
	e)	Other tree species may include: *Agonis flexuosa, Banksia grandis, Banksia attenuata, Eucalyptus marginata,* less commonly *Corymbia calophylla, Banksia menziesii, Banksia prionotes.*	
	f)	Understorey is structurally variable. Common species include: *Hardenbergia comptoniana*, *Daucus glochidiatus* and *Trachymene pilosa* (although can be without)	
Characteristic of the TEC?			**Yes**

Tuart Woodlands and Forests Patch

The single Tuart woodlands and forests TEC patch within the study area has been mapped in accordance with the methodologies and requirements described in the approved Conservation Advice (DEE 2019), where the patch encompasses the canopy of the Tuart trees, plus a 30 m buffer (**Figure 12**).

Tuart Woodlands and Forests Condition and Condition Threshold

Within the study area, the area of Tuart woodlands and forests TEC (vegetation unit Eg) was found to be in 'Completely Degraded to Degraded' condition, in accordance with an adaptation of the Keighery (1994) condition scale (**Figure 10**)

The Conservation Advice (DEE 2019) specifies the following criteria for patches to be included as part of the nationally protected ecological community:

- <0.5 ha – NOT part of the nationally protected ecological community
- At least 0.5 ha to <5 ha - patches in this range are presumed to be part of the nationally protected ecological community unless they do not meet the minimum condition
- ≥5 ha – that meet the key diagnostic characteristics are part of the nationally protected ecological community.

The single patch of Tuart woodlands and forests TEC within the study area is 0.41 ha and therefore, in accordance with the Conservation Advice (DEE 2019), is not a representation of the TEC that is eligible for inclusion as part of the nationally protected TEC.

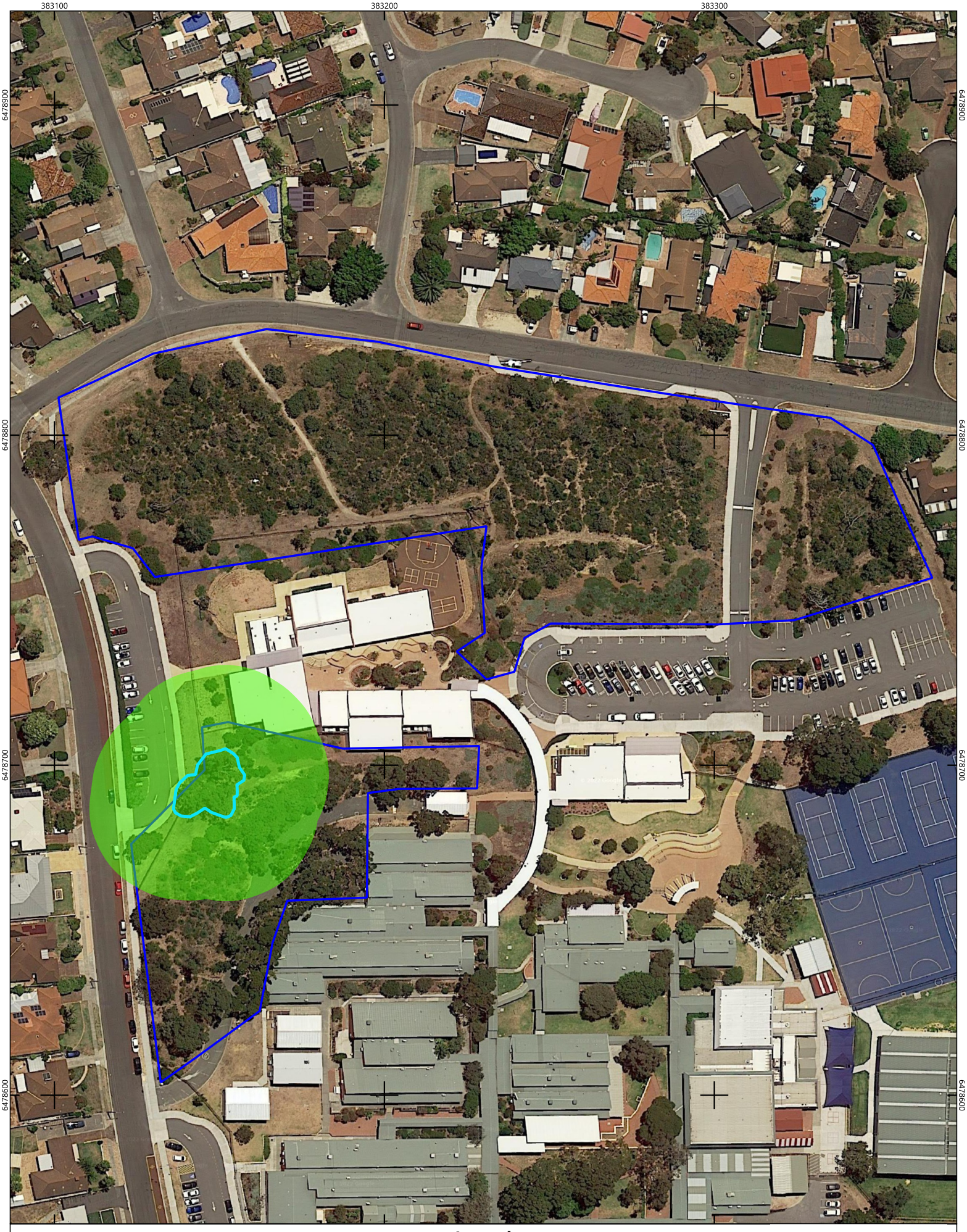

Figure 12 - Tuart Woodland and Forest Patch

FOCUSED VISION consulting

5.2.3.2 *Banksia Woodlands TEC*

DBCA records indicate that no areas of the Endangered Banksia woodlands of the Swan Coastal Plain TEC have been previously identified within the study area.

Statistical analysis indicates that the Banksia woodland vegetation unit (BaAh) defined within the study area, shows affinity to FCT 28 and FCT 23c. Individually, neither of these FCTs are considered to be a State or Commonwealth listed TEC or PEC, however they both form part of the Commonwealth-listed Banksia woodlands TEC (**Table 10**).

Banksia Woodlands TEC Characterisation

In order to determine the equivalence of the defined vegetation to the Banksia woodlands TEC, all sampled quadrats in 'Good' or better condition within the vegetation unit that contains Banksia species (BaAh) were characterised using a checklist developed based on the Conservation Advice (TSSC 2016). The checklist includes the key characteristics of the TEC, including botanical region, soil and landform types and required or typical species for each stratum (**Table 14**). The results of this analysis determined that vegetation unit BaAh is characteristic of the Banksia woodlands TEC.

Table 14 - Banksia Woodlands TEC Characterisation of the Recorded BaAh Quadrats

Key Characters		Quadrat		
		DC04	DC05	DC06
Key Character (see key)	a) Swan Coastal Plain or Jarrah Forest location	+	+	+
	b) Soils and landform either deep Bassendean, Spearwood or occasionally Quindalup sands, sandy colluvium, Aeolian sands of the Ridge Hill Shelf or Whicher Scarp	+	+	+
	c) Distinctive upper sclerophyllous layer dominated by *Banksia attenuata, Banksia menziesii, Banksia ilicifolia* or *Banksia prionotes*	+	+	+
	d) With (although can be without) an emergent tree layer of *Corymbia calophylla, Eucalyptus marginata* or *Eucalyptus gomphocephala*			
	e) With (although can be without) other trees including *Eucalyptus todtiana, Nuytsia floribunda, Allocasuarina fraseriana, Callitris arenaria, Callitris pyramidalis* or *Xylomelum occidentale*			
	f) Understorey/mid-ground sclerophyllous shrub layer including mostly Asteraceae, Dilleniaceae, Droseraceae, Ericaceae, Fabaceae, Haemodoraceae, Iridaceae, Myrtaceae, Orchidaceae, Proteaceae, Restionaceae	+	+	+
	g) Herbaceous ground layer including mostly Apiaceae, Asteraceae, Cyperaceae, Haemodoraceae, Poaceae, Restionaceae, Stylidiaceae	+		+
Characteristic of the TEC?		**Yes**	**Yes**	**Yes**

Banksia Woodland Extent, Patch and Condition Threshold

The extent of Banksia woodland across the study area was determined to be all areas supporting remnant native vegetation unit BaAh, as presented in **Figure 9**.

In order to determine the Banksia woodland patch/es within the study area, the stipulation of the Conservation Advice (TSSC 2016), that areas of Banksia woodland are separated by not more than 30 m (of cleared or built-up areas or non-Banksia woodland vegetation) form part of the same patch was applied. All vegetation defined within BaAh occurring within the study area is considered to comprise a single Banksia woodland patch, which has a combined area of 1.05 ha. The study area is surrounded by developed areas and as such, the Banksia woodland patch does not extend beyond the bounds of the study area.

The vegetation condition of the single mapped Banksia woodland patch ranges from 'Completely Degraded to Degraded' to 'Good'. Therefore, the conservative average condition of the patch has been determined to be 'Good'.

To be considered eligible for inclusion as part of the nationally protected ecological community, patches of Banksia woodlands TEC must meet at least the 'Good' condition category as outlined in the Conservation Advice (TSSC 2016). The advice also stipulates condition thresholds and minimum patch sizes as follows:

- Pristine - no minimum patch size
- Excellent – 0.5 ha
- Very Good – 1 ha
- Good – 2 ha.

Based on the condition thresholds listed above, the Banksia woodland within the study area, representing vegetation unit BaAh, is not a representation of the TEC that is eligible for inclusion as part of the nationally protected TEC.

6 DISCUSSION

6.1 FLORA

A total of 76 flora species, from 64 genera and 31 families was recorded during the survey. The dominant families were found to be Fabaceae (14 taxa), Poaceae (8 taxa species) and Proteaceae (8 taxa). The total includes 57 (75%) native species and 19 (25%) introduced (weed) species. The proportion of weeds species recorded from within the study area is considered to be relatively high and is largely attributed to adjacent land uses and disturbances. This high weed disturbance is evident in the delineated vegetation condition at the study area, which ranges from 'Completely Degraded' to 'Good'. Better condition vegetation 'Good' or 'Degraded-Good' occurs towards the centre of the vegetation directly adjacent to Sullivan Road.

No species listed as Threatened flora under the BC Act or under the EPBC Act were recorded despite extensive search traverses. The desktop assessment indicated that no Threatened flora afforded protection under these Acts, were considered likely to occur due to the lack of suitable habitat or the distance to known current locations of these species.

During interrogation of the DBCA Threatened and Priority flora database search results, two priority flora *Acacia benthamii* (Priority 2) and *Jacksonia sericea* (Priority 4) were considered likely to occur. *Acacia benthamii* (Priority 2) was not recorded during the current survey. A total of two individual *Jacksonia sericea* (Priority 4) were recorded during the Spring 2021 assessment within vegetation unit BaAh and CcXp. This species is widely distributed within the Swan Coastal Plain between Wanneroo and Mandurah.

The flora and vegetation field assessments were conducted during, the optimal spring season for biological surveys on the Swan Coastal Plain. A total of 122.8 mm of rain was recorded during October 2021, well above the long-term mean (40.9 mm). The above average winter rainfall during the growth stage, would have promoted the production of new leaves and increase the number (and quality) of flowers and fruit (Chen *et al.* 2019).

None of the recorded naturally occurring flora exhibited an extension beyond their currently documented range, in accordance with records of the Western Australian Herbarium (1998-).

No taxa listed as Declared Pest [s22(2)] plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (DPIRD 2021) were recorded. In addition, none of the species recorded are listed as Weeds of National Significance (WoNS) (DAWE 2021c).

6.2 VEGETATION

Nine vegetation units were defined and mapped within the study area and comprised of four intact vegetation units and five highly modified or planted units (**Table 11**). The condition of the vegetation within the study area was found to range from 'Good' to 'Completely Degraded'. The majority of the vegetation was observed to be in 'Completely Degraded' condition. The poor condition of the vegetation within the study area is typical of small remnants that remain within developed areas, where weed invasion and degradation from other impacts such as trampling and rubbish dumping are generally ongoing. Due to the highly modified and disturbed nature of the eastern and southern portions of the study area, only one vegetation unit, BaAh, was sampled from three quadrats. All other vegetation units were sampled and characterised via relevés or visual observations.

6.2.1 Threatened and Priority Ecological Communities

None of the defined vegetation units are considered to be representative of any State or Commonwealth listed TEC or PEC, including the Commonwealth listed Tuart woodlands and forests and the Banksia woodlands TECs, despite the presence of vegetation that is characteristic of both of these ecological communities. Both areas of vegetation characteristic of the respective TECs were found to be of inadequate quality and size to meet condition thresholds and render them are eligible for inclusion as part of either nationally protected TEC.

6.2.2 Vegetation Representation

EPA's Position Statement No. 2 lists a series of objectives which relate to biodiversity (EPA 2000). One of them is to protect at least 30% of the original extent of vegetation complexes in unconstrained areas and 10% in constrained areas (i.e. urban regions).

The remaining extent of the single vegetation association (988) as documented by Beard (1990) within the City of Joondalup, falls below the 10% retention target, although this vegetation association is represented by more than 30% of its pre-European extent across the broader Perth IBRA sub-region, on the Swan Coastal Plain and across all of Western Australia.

Similarly, the remaining extent of the single vegetation complex (Cottesloe - Central and South) as documented by Heddle *et al.* (1980) within the City of Joondalup, also falls below the 10% retention target, although this vegetation complex is represented by more than 30% of its pre-European extent across the Swan Coastal Plain.

6.2.3 Vegetation of Significance

Due to supporting Priority flora (*Jacksonia sericea,* Priority 4), vegetation units BaAh and CcXp are considered to be of regional significance, although as noted above, this species is widely distributed on the Swan Coastal Plain between Wanneroo and Mandurah.

The vegetation of the study area is not considered to be of significance due to other factors, including:

- the presence of conservation-significant ecological communities (TECs or PECs)
- the presence of undescribed or range extending flora
- occurring in association with Ramsar or conservation category wetlands
- being part of or under consideration for inclusion in the conservation estate
- maintaining important ecological processes
- having restricted or limited regional representation and/or distribution or occurring as small, isolated communities.

7 CONCLUSIONS

The key findings and conclusions arising from the flora and vegetation assessment within the study area:

- No Threatened flora listed under the BC Act or the EPBC Act were recorded.
- One Priority 4 flora species, *Jacksonia sericea,* as listed by DBCA was recorded.
- No weeds listed as WoNS or DP plants under the BAM Act were recorded.
- Nine vegetation units were defined and mapped within the study area, which comprised of four intact vegetation units and five highly modified or planted units.
- Although vegetation that was determined to be characteristic of the Commonwealth listed Tuart woodlands and forests and the Banksia woodlands TECs is present within the study area, neither are of adequate quality and size to meet condition thresholds and render them are eligible for inclusion as part of either nationally protected TEC and in conclusion, none of the defined vegetation units are considered to be representative of any State or Commonwealth listed TEC or PEC.
- The remaining extent of the single vegetation association and vegetation complex present within the study area falls below the 10% retention target in the context of the City of Joondalup, although the extent does exceed 30% for the Swan Coastal Plan, Perth IBRA sub-region and Western Australia.
- Vegetation units BaAh and CcXp are considered to be of regional significance, due to supporting populations of *Jacksonia sericea* (P4).
- The vegetation of the study area is not considered to be of significance due to other factors relevant to the assessment of vegetation significance.

8 LIST OF PARTICIPANTS

The personnel who contributed to the project are summarised in **Table 22**.

Table 15 – Project Team

Name	Qualification	Years of Relevant Experience	Role
Kellie Bauer–Simpson Principal Ecologist	BSc. (Biological Science)	23	Project manager, field assessment, GIS mapping, technical and authorisation review
Lisa Chappell Senior Botanist/Environmental Scientist	BEnvSc. (Hons) (Environmental Science)	18	Field assessment, data management, floristic analysis, GIS mapping, report preparation
Catherine Krens Senior Environmental Consultant/Botanist	BSc. (Botany/Plant Biology)	14	Field assessment
Kristen Bleby Senior Ecologist	B.Sc. (Hons) Natural Resource Management PhD (Conservation Ecology)	10	Technical review
Kelly Hopkinson Graduate Ecologist	BSc. (Biological Science and Conservation Biology)	1	Report preparation
Shibi Chandran Botanical Taxonomist	BSc. (Zoology) MSc. (Fisheries and Aquaculture)	11	Flora identification
Will Bauer–Simpson Technician/Advisor	Cert IV (Health and Safety)	10	Field assistance, field safety and logistics planning, GIS mapping, spatial analysis, spatial data management
Megan Meadowcroft Administration		5	Data entry, editorial support

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APPENDIX A - DBCA NATURE MAP SEARCH REPORT

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 28/10/2021

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 45' 57" E,31° 49' 16" S
Buffer 1km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
2.	24262	*Acanthiza inornata (Western Thornbill)*			
3.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
4.		*Amblyomma triguttatum*			
5.		*Aname mainae*			
6.	24561	*Anthochaera carunculata (Red Wattlebird)*			
7.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
8.		*Artoria linnaei*			
9.		*Austrammo harveyi*			
10.		*Ballarra longipalpus*			
11.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
12.	25715	*Cacatua roseicapilla (Galah)*			
13.	25716	*Cacatua sanguinea (Little Corella)*			
14.	15330	*Caladenia arenicola*			
15.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
16.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
17.		*Cercophonius granulosus*			
18.	24980	*Christinus marmoratus (Marbled Gecko)*			
19.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
20.		*Cormocephalus aurantiipes*			
21.		*Cormocephalus novaehollandiae*			
22.	25592	*Corvus coronoides (Australian Raven)*			
23.	25595	*Cracticus tibicen (Australian Magpie)*			
24.	25596	*Cracticus torquatus (Grey Butcherbird)*			
25.		*Crustulina bicruciata*			
26.	30893	*Cryptoblepharus buchananii*			
27.		*Cryptoerithus quobba*			
28.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
29.	25027	*Ctenotus australis*			
30.	25039	*Ctenotus fallens*			
31.	25087	*Cyclodomorphus celatus (Western Slender Blue-tongue)*			
32.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
33.	17663	*Desmocladus asper*			
34.		*Dingosa serrata*			
35.	24939	*Diplodactylus polyophthalmus*			
36.	7962	*Dittrichia viscosa*	Y		
37.	25251	*Echiopsis curta (Bardick)*			
38.		*Eolophus roseicapillus*			
39.		*Ethmostigmus rubripes*			
40.	5615	*Eucalyptus decipiens (Limestone Marlock, Moit)*			
41.	25621	*Falco berigora (Brown Falcon)*			
42.	25623	*Falco longipennis (Australian Hobby)*			
43.	25530	*Gerygone fusca (Western Gerygone)*			
44.	24443	*Grallina cyanoleuca (Magpie-lark)*			
45.	25475	*Hemiergis peronii*			
46.	25119	*Hemiergis quadrilineata*			
47.		*Henicops dentatus*			
48.		*Hogna immansueta*			
49.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
50.	4027	*Jacksonia sericea (Waldjumi)*		P4	
51.		*Lamponella kimba*			
52.		*Latrodectus hasseltii*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.	25133	*Lerista elegans*			
54.	25165	*Lerista praepedita*			
55.	25005	*Lialis burtonis*			
56.	25661	*Lichmera indistincta (Brown Honeyeater)*			
57.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
58.		*Longepi woodman*			
59.	1198	*Luzula meridionalis (Field Woodrush)*			
60.		*Lycosa austicola*			Y
61.		*Lycosa australicola*			
62.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
63.		*Maratus pavonis*			
64.		*Masasteron tuart*			
65.	25184	*Menetia greyii*			
66.	24598	*Merops ornatus (Rainbow Bee-eater)*			
67.		*Missulena granulosa*			
68.		*Mitzoruga insularis*			
69.		*Molycria vokes*			
70.	25192	*Morethia obscura*			
71.	24223	*Mus musculus (House Mouse)*	Y		
72.	25420	*Myobatrachus gouldii (Turtle Frog)*			
73.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
74.		*Notiasemus glauerti*			
75.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
76.	25682	*Pardalotus striatus (Striated Pardalote)*			
77.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
78.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
79.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
80.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
81.		*Polytelis swainsonii*			Y
82.	25511	*Pseudonaja affinis (Dugite)*			
83.		*Raveniella cirrata*			
84.		*Raveniella peckorum*			
85.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
86.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
87.	30948	*Smicrornis brevirostris (Weebill)*			
88.		*Steatoda capensis*			
89.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
90.		*Supunna funerea*			
91.		*Supunna picta*			
92.		*Synothele durokoppin*			
93.		*Synothele michaelseni*			
94.	25519	*Tiliqua rugosa*			
95.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
96.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
97.		*Venator immansueta*			
98.		*Zachria flavicoma*			
99.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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

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

APPENDIX B - EPBC PROTECTED MATTERS SEARCH REPORT

Australian Government

Department of Agriculture, Water and the Environment

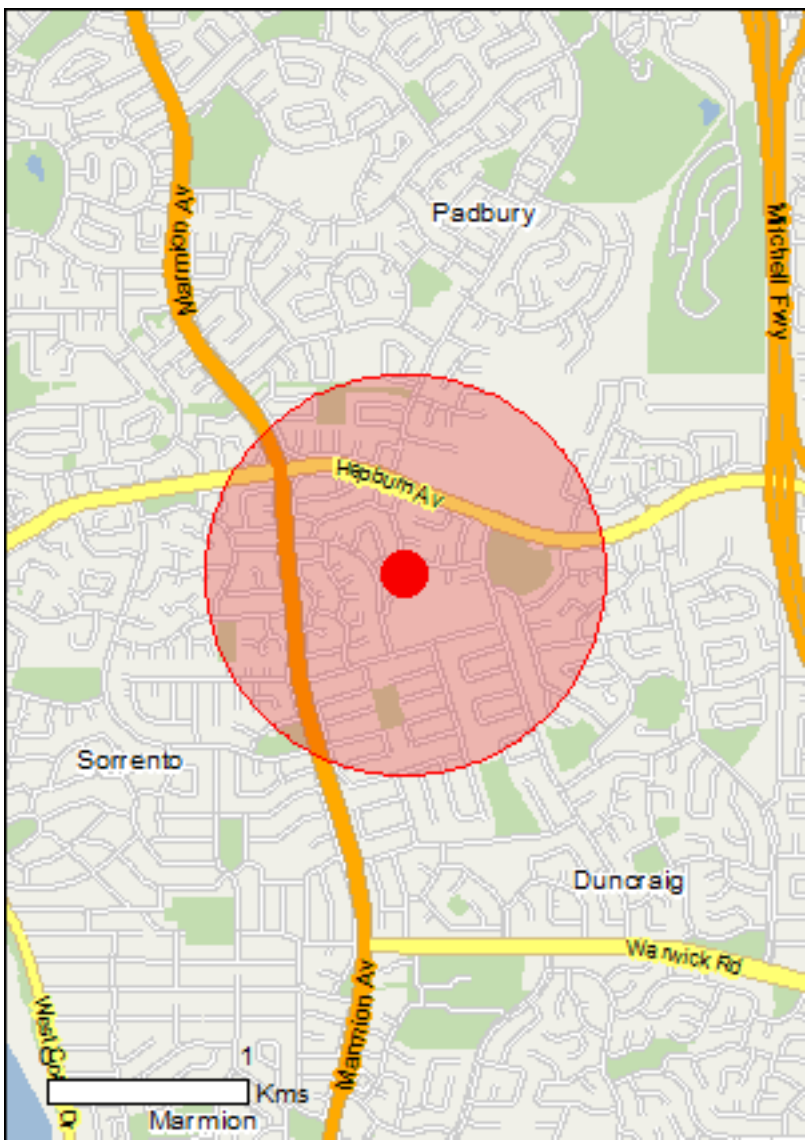
EPBC Act Protected Matters Report

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

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

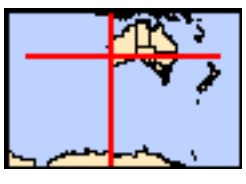
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/10/21 16:33:43



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	18
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	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.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Insects		
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within 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
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-31.82077 115.76616

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 C – FLORA SPECIES BY VEGETATION UNIT

*denotes introduced (weed) species

Family		Taxon	Vegetation Unit								
			BaAh	CcBm	CcXp	EmXp	Eg	Esp	Cc	PA	PS1
Apiaceae		*Daucus glochidiatus*	+								
Asparagaceae		*Dianella revoluta*	+		+						
Asparagaceae		*Lomandra ?hermaphrodita*	+								
Asparagaceae		*Thysanotus manglesianus*			+						
Asteraceae	*	*Hypochaeris glabra*	+								+
Asteraceae	*	*Ursinia anthemoides*	+		+						
Asteraceae		*Waitzia acuminata*	+								
Campanulaceae	*	*Wahlenbergia capensis*	+								
Casuarinaceae		*Allocasuarina humilis*	+			+					
Colchicaceae		*Burchardia congesta*	+								
Cyperaceae		*Mesomelaena pseudostygia*	+		+	+					
Cyperaceae		*Morelotia octandra*	+								
Cyperaceae		*Schoenus clandestinus*	+								
Dilleniaceae		*Hibbertia hypericoides*	+			+					
Ericaceae		*Conostephium pendulum*	+								
Ericaceae		*Leucopogon polymorphus*	+								
Euphorbiaceae	*	*Euphorbia terracina*	+			+					+
Fabaceae	*	*Acacia longifolia*	+								+
Fabaceae		*Acacia pulchella*	+		+						
Fabaceae		*Acacia saligna*		+	+	+					
Fabaceae		*Acacia* sp.								+	
Fabaceae		*Daviesia nudiflora*	+								
Fabaceae		*Gastrolobium capitatum*	+								
Fabaceae		*Gompholobium tomentosum*	+			+					
Fabaceae		*Hardenbergia comptoniana*	+		+	+					
Fabaceae		*Hovea pungens*	+								
Fabaceae		*Hovea trisperma*	+	+							

Family		Taxon	Vegetation Unit								
			BaAh	CcBm	CcXp	EmXp	Eg	Esp	Cc	PA	PS1
Fabaceae		*Isotropis cuneifolia subsp. cuneifolia*	+								
Fabaceae		*Jacksonia sericea* (P4)	+		+						
Fabaceae		*Templetonia retusa*			+						
Fabaceae	*	*Trifolium campestre*	+								
Goodeniaceae		*Scaevola repens*	+								
Haemodoraceae		*Conostylis aculeata*	+		+						
Haemodoraceae		*Conostylis aculeata* subsp. *cygnorum*	+								
Haemodoraceae		*Conostylis setosa*	+								
Hemerocallidaceae		*Caesia micrantha*	+								
Hemerocallidaceae		*Tricoryne elatior*			+						
Iridaceae	*	*Gladiolus caryophyllaceus*	+		+						
Iridaceae	*	*Romulea rosea*	+								
Myrtaceae		*Calothamnus quadrifidus*	+								
Myrtaceae		*Chamelaucium uncinatum*		+							+
Myrtaceae		*Corymbia calophylla*		+	+				+		
Myrtaceae		*Eucalyptus gomphocephala*					+				
Myrtaceae		*Eucalyptus marginata*				+					
Myrtaceae	#	*Eucalyptus* sp.						+			+
Myrtaceae		*Melaleuca systena*	+		+						
Oxalidaceae	*	*Oxalis pes-caprae*	+								
Papaveraceae	*	*Fumaria capreolata*	+								
Phyllanthaceae		*Phyllanthus calycinus*			+						
Poaceae		*Austrostipa flavescens*	+								
Poaceae	*	*Avena barbata*	+	+	+						+
Poaceae	*	*Briza maxima*	+								
Poaceae	*	*Briza minor*	+								
Poaceae	*	*Bromus* sp.									+
Poaceae	*	*Cynodon dactylon*							+		+
Poaceae	*	*Ehrharta calycina*	+	+	+	+	+	+	+	+	+

Family		Taxon	Vegetation Unit								
			BaAh	CcBm	CcXp	EmXp	Eg	Esp	Cc	PA	PS1
Poaceae	*	*Lagurus ovatus*	+								
Portulacaceae		*Calandrinia quadrivalvis*	+								
Primulaceae	*	*Lysimachia arvensis*	+								
Proteaceae		*Banksia attenuata*	+			+					
Proteaceae		*Banksia dallanneyi*			+						
Proteaceae		*Banksia menziesii*	+	+							
Proteaceae		*Grevillea crithmifolia*			+						
Proteaceae		*Hakea trifurcata*	+			+					
Proteaceae		*Petrophile linearis*	+								
Proteaceae		*Petrophile macrostachya*	+								
Proteaceae		*Stirlingia latifolia*				+					
Restionaceae		*Alexgeorgea nitens*	+								
Restionaceae		*Desmocladus flexuosus*	+								
Rubiaceae		*Opercularia vaginata*	+								
Santalaceae		*Santalum acuminatum*	+								
Scrophulariaceae		*Eremophila glabra*									+
Stylidiaceae		*Stylidium repens*	+								
Thymelaeaceae		*Pimelea sulphurea*	+								
Xanthorrhoeaceae		*Xanthorrhoea preissii*	+	+	+	+					
Zamiaceae		*Macrozamia riedlei*	+	+							

APPENDIX D – VEGETATION SITE DATA

Site DC01R

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383335mE 6478779mN
Vegetation Unit	EmXp - *Eucalyptus marginata* Low Open Woodland *over Banksia attenuata* Woodland over *Acacia saligna* and *Xanthorrhoea preissii* Tall Open Shrubland over *Allocasuarina humilis* and *Hibbertia hypericoides* Low Sparse Shrubland
Slope	Gentle
Landform	Lower Slope
Soil Colour	grey
Soil Type	sand
Litter	5%
Bare Ground	0%
Fire Age	3-5 Years
Vegetation Condition	Degraded
Disturbances/Impacts	weeds

Species	Height (cm)	% Cover
Eucalyptus marginata	8	25
Acacia saligna	4	2
Banksia attenuata	4	2
Xanthorrhoea preissii	2	8
Ehrharta calycina	1.2	25
Allocasuarina humilis	0.8	2
Hibbertia hypericoides	0.8	5
Gompholobium tomentosum	0.6	5
Euphorbia terracina		+
Hakea trifurcata		+
Hardenbergia comptoniana		+
Mesomelaena pseudostygia		+
Stirlingia latifolia		+

Site DC02R

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383319mE 6478783mN
Vegetation Unit	PS1 - Planted endemic and non locally endemic species over introduced weeds and grasses
Slope	Gentle
Landform	Mid Slope
Soil Colour	grey
Soil Type	sand
Litter	50%
Bare Ground	10%
Fire Age	>10 Years
Vegetation Condition	Completely Degraded
Disturbances/Impacts	weeds

Species	Height (cm)	% Cover
Chamelaucium uncinatum	2	30
Avena barbata	0.6	20
Hypochaeris glabra	0.6	20
Cynodon dactylon	0.3	5
Eremophila glabra	0.3	10
Acacia longifolia		+
Bromus sp.		+
Ehrharta calycina		+
Eucalyptus sp.		+
Euphorbia terracina		+

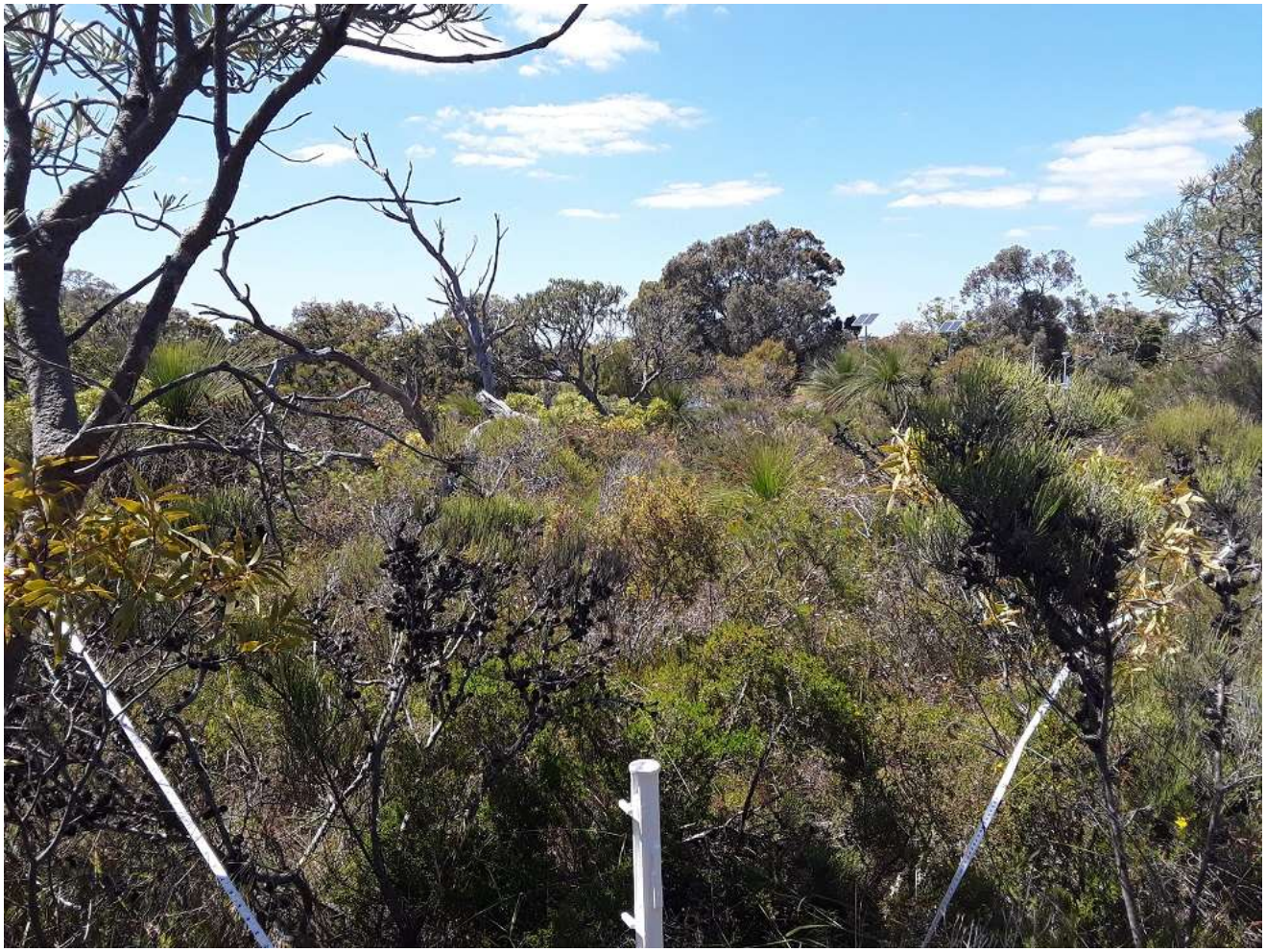
Site DC03R

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383336mE 6478786mN
Vegetation Unit	BaAh - *Banksia attenuata* and *Banksia menziesii* Low Open Woodland over *Allocasuarina humilis* and *Calothamnus quadrifidus* Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland
Slope	Gentle
Landform	Mid Slope
Soil Colour	pale yellow
Soil Type	sand
Litter	10%
Bare Ground	3%
Fire Age	>10 Years
Vegetation Condition	Degraded
Disturbances/Impacts	weeds

Species	Height (cm)	% Cover
Banksia attenuata	4	10
Allocasuarina humilis	1.5	15
Calandrinia quadrivalvis	1.5	10
Macrozamia riedlei	1.5	5
Avena barbata	1.2	15
Ehrharta calycina	1.2	20
Xanthorrhoea preissii	0.8	5
Hibbertia hypericoides	0.3	5
Briza maxima		+
Hardenbergia comptoniana		+
Ursinia anthemoides		+

Site DC04

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383264mE 6478793mN
Vegetation Unit	BaAh - *Banksia attenuata* and *Banksia menziesii* Low Open Woodland over *Allocasuarina humilis* and *Calothamnus quadrifidus* Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland
Slope	Gentle
Landform	Upper Slope
Soil Colour	pale yellow
Soil Type	sand
Litter	10%
Bare Ground	3%
Fire Age	5-10 Years
Vegetation Condition	Good
Disturbances/Impacts	weeds



Species	Height (cm)	% Cover
Banksia attenuata	3	1
Calandrinia quadrivalvis	1.5	3
Allocasuarina humilis	1.2	5
Santalum acuminatum	1.2	7
Gompholobium tomentosum	0.6	1
Hibbertia hypericoides	0.3	7
Avena barbata		+
Briza maxima		+
Briza minor		+
Burchardia congesta		+
Caesia micrantha		+
Conostephium pendulum		+
Conostylis setosa		+
Daucus glochidiatus		+
Daviesia nudiflora		+
Desmocladus flexuosus		+
Ehrharta calycina		+
Gastrolobium capitatum		+
Gladiolus caryophyllaceus		+
Hovea pungens		+
Hovea trisperma		+
Hypochaeris glabra		+
Isotropis cuneifolia subsp. *cuneifolia*		+
Jacksonia sericea		+
Leucopogon polymorphus		+
Melaleuca systena		+
Mesomelaena pseudostygia		+
Petrophile macrostachya		+
Romulea rosea		+
Schoenus clandestinus		+
Stylidium repens		+
Tetraria octandra		+
Trifolium campestre		+
Ursinia anthemoides		+
Xanthorrhoea preissii		+
Austrostipa flavescens		Associated

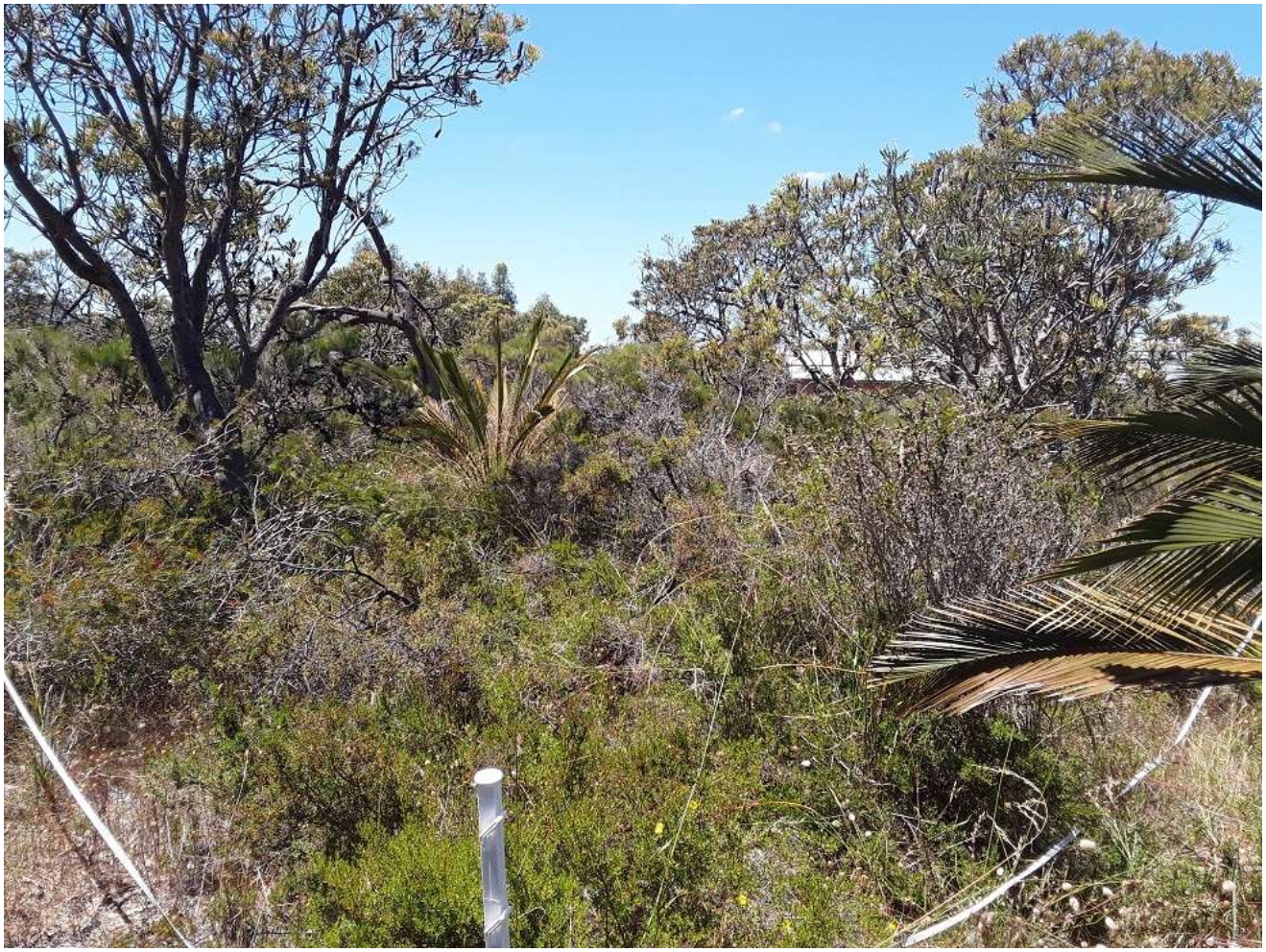
Site DC05

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383197 6478812mN
Vegetation Unit	BaAh - *Banksia attenuata* and *Banksia menziesii* Low Open Woodland over *Allocasuarina humilis* and *Calothamnus quadrifidus* Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland
Slope	Gentle
Landform	Mid Slope
Soil Colour	grey
Soil Type	sand
Litter	10%
Bare Ground	3%
Fire Age	5-10 Years
Vegetation Condition	Good
Disturbances/Impacts	weeds

Species	Height (cm)	% Cover
Banksia attenuata	4	OH
Banksia menziesii	3	2
Allocasuarina humilis	1.8	20
Melaleuca systena	0.8	3
Hibbertia hypericoides	0.4	10
*Avena barbata**		+
*Briza maxima**		+
*Briza minor**		+
Burchardia congesta		+
Calothamnus quadrifidus		+
Conostephium pendulum		+
Conostylis aculeata subsp. *cygnorum*		+
Daucus glochidiatus		+
Daviesia nudiflora		+
Desmocladus flexuosus		+
Dianella revoluta		+
*Ehrharta calycina**		+
*Euphorbia terracina**		+
*Fumaria capreolata**		+
Hakea trifurcata		+
Hovea pungens		+
Hovea trisperma		+
*Hypochaeris glabra**		+
*Lagurus ovatus**		+
Lomandra ?hermaphrodita		+
*Lysimachia arvensis**		+
Macrozamia riedlei		+
Mesomelaena pseudostygia		+
Opercularia vaginata		+
Petrophile macrostachya		+
Pimelea sulphurea		+
*Romulea rosea**		+
Schoenus clandestinus		+
Stylidium repens		+
Tetraria octandra		+
Trifolium campestre		+
Ursinia anthemoides		+
*Wahlenbergia capensis**		+
Waitzia acuminata		+
Xanthorrhoea preissii		+
Santalum acuminatum		Associated

Site DC06

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383140mE 6478813mN
Vegetation Unit	BaAh - *Banksia attenuata* and *Banksia menziesii* Low Open Woodland over *Allocasuarina humilis* and *Calothamnus quadrifidus* Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland
Slope	Gentle
Landform	Mid Slope
Soil Colour	grey
Soil Type	sand
Litter	5%
Bare Ground	1%
Fire Age	5-10 Years
Vegetation Condition	Good
Disturbances/Impacts	weeds



Species	Height (cm)	% Cover
Banksia attenuata	4.5	10
Banksia menziesii	4.5	3
Allocasuarina humilis	1.2	7
Calothamnus quadrifidus	1	2
Hibbertia hypericoides	0.4	15
*Acacia longifolia**		Associated
Acacia pulchella		+
Alexgeorgea nitens		+
*Avena barbata**		+
*Briza maxima**		+
*Briza minor**		+
Conostephium pendulum		+
Conostylis aculeata		+
Conostylis aculeata subsp. *cygnorum*		+
Daucus glochidiatus		+
Dianella revoluta		+
*Ehrharta calycina**		+
*Gladiolus caryophyllaceus**		+
Gompholobium tomentosum		+
Hakea trifurcata		+
Hardenbergia comptoniana		+
Hovea pungens		+
*Hypochaeris glabra**		+
Isotropis cuneifolia subsp. *cuneifolia*		+
Lagurus ovatus		+
Lysimachia arvensis		+
Macrozamia riedlei		+
Melaleuca systena		+
Mesomelaena pseudostygia		+
Opercularia vaginata		+
Oxalis pes-caprae		+
Petrophile linearis		+
Scaevola repens		+
Schoenus clandestinus		+
Trifolium campestre		+
Ursinia anthemoides		+
Waitzia acuminata		+
Acacia longifolia		Associated

Site DC07R

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383203mE 6478699mN
Vegetation Unit	CcBm - *Corymbia calophylla* Woodland over *Banksia menziesii* Low Open Woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* Low Sparse Shrubland
Slope	Moderate
Landform	Mid Slope
Soil Colour	pale yellow
Soil Type	sand
Litter	10%
Bare Ground	3%
Fire Age	5-10 Years
Vegetation Condition	Completely Degraded-Degraded
Disturbances/Impacts	weeds

Species	Height (cm)	% Cover
Corymbia calophylla	12	20
Banksia menziesii	3.5	3
Macrozamia riedlei	1	1
Xanthorrhoea preissii	1	1
Acacia saligna		+
Avena barbata		+
Chamelaucium uncinatum		+
*Ehrharta calycina**		+
Hovea trisperma		+

Site DC08R

Date	10/11/2021
Botanist	Lisa Chappell
Quadrat Size	10 x 10 m
NW Corner Coordinates	383146mE 6478652mN
Vegetation Unit	CcXp - *Corymbia calophylla* Low Open Woodland over *Xanthorrhoea preissii* Tall Sparse Shrubland over *Templetonia retusa* and *Melaleuca systena* Low Sparse Shrubland
Landform	Upper Slope
Soil Colour	grey
Soil Type	sand
Litter	10%
Bare Ground	0%
Fire Age	5-10 Years
Vegetation Condition	Degraded
Disturbances/Impacts	weeds and rubbish, lots of rubbish

Species	Height (cm)	% Cover
Corymbia calophylla	6	5
Xanthorrhoea preissii	2.5	7
Templetonia retusa	1.2	3
Melaleuca systena	1	2
Tricoryne elatior	0.3	5
Acacia pulchella		+
Acacia saligna		+
*Avena barbata**		+
Banksia dallanneyi		+
Conostylis aculeata		+
Dianella revoluta		+
*Ehrharta calycina**		+
*Gladiolus caryophyllaceus**		+
Grevillea crithmifolia		+
Hardenbergia comptoniana		+
Jacksonia sericea (P4)		+
Mesomelaena pseudostygia		+
Phyllanthus calycinus		+
Thysanotus manglesianus		+
*Ursinia anthemoides**		+