

FINAL

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DETAILED FLORA AND VEGETATION ASSESSMENT

Osprey Project

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tronox Holdings plc

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Executive Summary

Tronox Holdings PLC (Tronox) operates a large mineral sands mining operation at the company's Cooljarloo mine at Cataby, 160 kilometres (km) north of Perth in the northern extent of the Swan Coastal Plain (SCP) Region of Western Australia (WA). Tronox is proposing expansion of mining at Cooljarloo to the west of existing mining areas (the Project). The expansion area, named Osprey (previously referred to as 'Falcon West'), is located within a larger area of intact native vegetation surveyed by Woodman Environmental Consulting Pty Limited (Woodman Environmental) (now Umwelt (Australia) Pty Limited (Umwelt)) between 2006 and 2012 as part of the Cooljarloo West project (Woodman Environmental, 2014b). A number of other historical flora and vegetation surveys have also been conducted on behalf of Tronox in the Cooljarloo area.

Umwelt were commissioned by Tronox in to undertake a Detailed Flora and Vegetation Assessment of the Osprey project area (hereafter referred to as the 'Survey Area', which is approximately 1,320 hectares (ha) in size) to provide Tronox with relevant and defendable data and documentation to support the environmental impact assessment (EIA) process for the Project, including updating vegetation data and mapping previously prepared for the Cooljarloo West project.

The flora and vegetation field survey involved sampling via quadrats and relevés within the Survey Area, and opportunistic survey for significant flora taxa. The survey was undertaken over two site visits in 2022:

- 3 to 7 October
- 17 to 21 October.

A total of 60 flora and vegetation survey quadrats (measuring 10 m \times 10 m) have been established in the Survey Area, as outlined below:

- 47 quadrats newly established in the Survey Area in 2022
- 13 quadrats established in the Survey Area by relevant previous surveys.

In addition, 30 relevés were surveyed in vegetation patterns that had already been adequately surveyed by at least three quadrats (in terms of areas mapped as Cooljarloo West vegetation types (VTs), and/or patterns identifiable via aerial photography interpretation), or in areas of vegetation in relatively degraded condition, or areas of vegetation that are too small or narrow to allow for the establishment of quadrats. An additional 13 relevés have been established in the Survey Area by relevant previous surveys.

Notes on vegetation pattern boundaries and distribution were also taken while traversing the Survey Area, as well as locations of significant, opportunistic and introduced flora taxa encountered while traversing between quadrats and relevés.

A total of 14 significant flora taxa were recorded, including one Threatened taxon listed under both Commonwealth and State legislation (*Anigozanthos viridis* subsp. *terraspectans*). Two significant flora taxa were recorded in the Survey Area for the first time by the 2022 survey, being *Hypocalymma quadrangulare* (P3) and *Poranthera asybosca* (P1); however, these taxa have previous known records in close proximity to the Survey Area. The 14 taxa recorded by the 2022 survey are:



- Anigozanthos viridis subsp. terraspectans (T)
- Babingtonia urbana (P3)
- Chordifex reseminans (P2)
- Conospermum scaposum (P3)
- Desmocladus nodatus (P3)
- Grevillea cooljarloo (P1)
- Hypocalymma quadrangulare (P3)
- Isopogon panduratus subsp. palustris (P3)
- Lepyrodia curvescens (P2)
- Persoonia rudis (P3)
- Poranthera asybosca (P1)
- Schoenus griffinianus (P4)
- Stylidium hymenocraspedum (P3)
- Verticordia lindleyi subsp. lindleyi (P4).

A likelihood of occurrence assessment was undertaken for the 80 significant flora taxa identified by the desktop assessment but not recorded by the 2022 survey. This assessment determined that one taxon, *Myriophyllum muelleri* (P1), would theoretically not be identifiable at the time of the 2022 survey; however, this taxon is considered unlikely to occur in the Survey Area, as habitat is not considered to be present (inundated winter-wet depressions, freshwater lagoons). The remaining 79 significant flora taxa were considered likely to be identifiable during the 2022 survey, either because the survey period coincides with the taxon's flowering period, or the taxon can be identified reliably when in fruit or sterile. Of these, 16 taxa were considered to possibly still occur in the Survey Area as suitable habitat is potentially present, and the Survey Area is within (or in close proximity to) the taxa's known ranges.

Eight VTs were defined and mapped based on the results of two floristic classification analyses; one analysis containing the 2022 quadrat data only, and the second containing data from quadrats established in 2022 and additional quadrats assessed for the Cooljarloo West survey that occur in the Survey Area. The six VTs represent two broad groups of vegetation, based on soils and topography:

- **Group 1** (prefix 'D' to indicate 'dry' vegetation types; VTs D-A to D-C):
 - Comprised of two broad vegetation types:
 - Banksia woodland to species-rich shrubland with emergent Banksia on undulating plains and dunes of deeper sand (VTs D-A and D-B).
 - Proteaceous heathland on low rocky ironstone hills (VT D-C).



- Group 2 (prefix 'W' to indicate 'wet' vegetation types; VTs W-A to W-E):
 - Comprised of multiple VTs consisting of occasional low isolated trees of a variety of species including *Melaleuca rhaphiophylla*, *Melaleuca preissiana* or *Banksia* spp. over Myrtaceous and Proteaceous heath on damp to wet lower slopes, plains, flats, open depressions and swamps.
 - Related to conditions of greater water availability; generally consists of vegetation associated with either wetland habitats (VTs W-B and W-C) or areas of higher moisture retention (i.e. soils with high clay content or impeding layer; VTs W-A, W-D and W-E).

VTs D-A and D-B are considered representative of the 'Banksia Woodland of the Swan Coastal Plain' Commonwealth Threatened Ecological Community (TEC)/State Priority Ecological Community (PEC), and are consequently considered significant in a regional context. An additional two VTs (VTs D-C and W-A) are considered potentially significant in a local and regional context for reasons other than formal listing, due to occurring on restricted landform types and/or having relatively restricted extents in the Survey Area.

Obligate and facultative phreatophytes were recorded at varying frequencies in VTs W-A, W-C, W-D and W-E; these VTs are therefore likely to represent groundwater dependent vegetation (GDV), as well as likely having some dependence on surface water flows. VTs D-A and D-B contain co-dominant facultative phreatophytes, and consequently these VTs potentially represent GDV where the depth to groundwater is less than 10 below ground level (mbgl). No phreatophytic tree taxa were recorded in VT W-B, but some phreatophytic shrub taxa are common in the VT; therefore, while this VT may be seasonally wet and surface-water dependent, it is also potentially representative of terrestrial GDV. However, data presenting the depth to groundwater across the Survey Area would assist to clarifying the potential groundwater dependence of the vegetation.

The majority of the vegetation in the Survey Area was rated and mapped as being in 'Excellent' condition, with intact vegetation structures, no or little evidence of impact to vegetation composition as a result of human or animal activities, and/or only low levels of introduced (weed) taxa. The mapped areas of 'Very Good' or lower generally corresponded to the vegetation bordering the farmland block, where edge effects, weed incursion, grazing and partial clearing were more significant.



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1.0 Introduction

1.1 Project Overview

Tronox Holdings PLC (Tronox) operates a large mineral sands mining operation at the company's Cooljarloo mine at Cataby, 160 kilometres (km) north of Perth in the northern extent of the Swan Coastal Plain (SCP) Region of Western Australia (WA). Tronox is proposing expansion of mining at Cooljarloo to the west of existing mining areas (the Project). The expansion area, named Osprey (previously referred to as 'Falcon West'), is located within a larger area of intact native vegetation surveyed by Woodman Environmental Consulting Pty Limited (Woodman Environmental) (now Umwelt (Australia) Pty Limited (Umwelt)) between 2006 and 2012 as part of the Cooljarloo West project (Woodman Environmental, 2014b). A number of other historical flora and vegetation surveys have also been conducted on behalf of Tronox in the Cooljarloo area.

Umwelt was commissioned by Tronox in 2022 to prepare a flora and vegetation gap analysis and survey design for the Osprey project. This gap analysis identified that while significant contextual information is available for the Project area, additional data was required to provide adequate information to inform an environmental impact assessment (EIA) for the Project and to satisfy current Environmental Protection Authority (EPA, 2016b) standards (Umwelt, 2022c).

Tronox subsequently commissioned Umwelt to undertake a Detailed Flora and Vegetation Assessment of the Osprey project area to provide Tronox with relevant and defendable data and documentation to support the EIA process for the Project, including updating vegetation data and mapping previously prepared for the Cooljarloo West project (Woodman Environmental, 2014b). This current Detailed Flora and Vegetation Assessment incorporates data collected for the Falcon West flora and vegetation gap analysis.

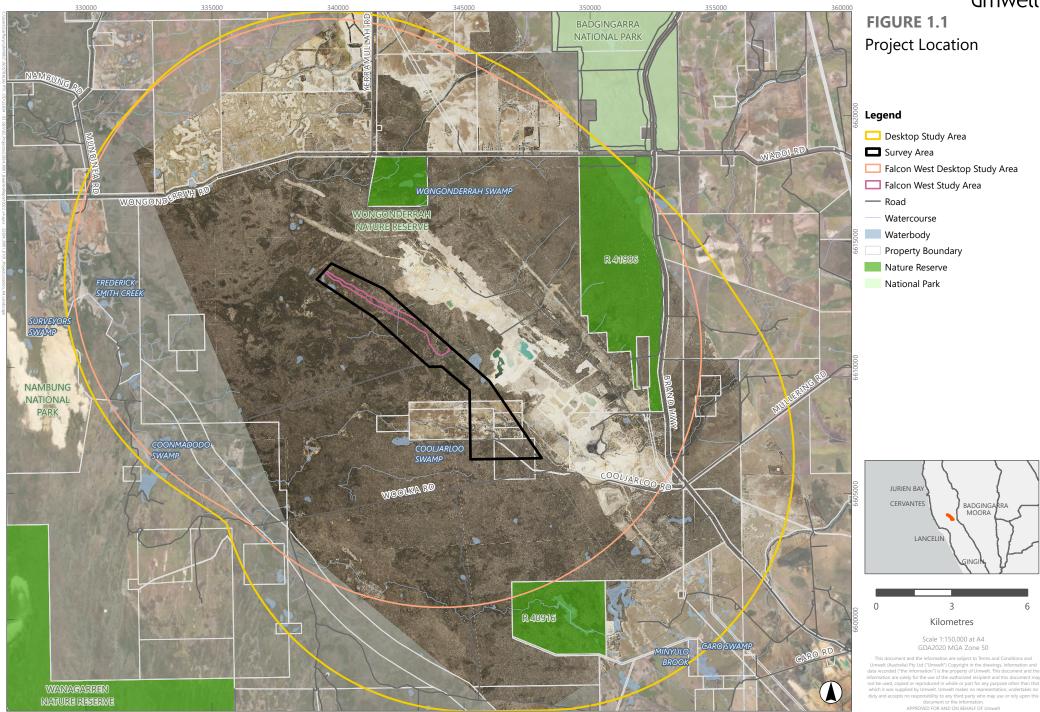
1.2 Project Area Location and Definitions

A Survey Area was defined for the flora and vegetation survey, corresponding with the Osprey project area, and generally encompassing the area previously assessed by Umwelt (2022c) for the Falcon West flora and vegetation gap analysis (hereafter referred to as the 'Falcon West Study Area'). The Survey Area is approximately 1,320 hectares (ha) in size (**Figure 1.1**).

A Desktop Study Area was defined for elements of the desktop assessment, including interrogation of databases and searches for relevant literature. The Desktop Study Area encompasses the Survey Area, with a 10 km buffer (**Figure 1.1**).

The area assessed by Umwelt (2022c) for the Falcon West gap analysis (i.e. the Falcon West Study Area) has also been presented in **Figure 1.1**, as well as the 'Falcon West Desktop Study Area', which incorporates the Falcon West Study Area with a 10 km buffer. Note that the Survey Area and Desktop Study Area extend further southeast than the Falcon West Study Area and Falcon West Desktop Study Area, respectively.





NATURE RESERVE



1.3 Aims and Objectives

The primary aim of this assessment was to characterise the flora and vegetation values of the Survey Area to the current regulatory standard, to provide relevant information to support the EIA process for the Project. This report presents and builds on the results of the desktop assessment and gap analysis prepared by Umwelt (2022c) for Falcon West.

The overall objectives of the assessment were to:

- Compile an inventory of vascular flora taxa that occur in the Survey Area.
- Opportunistically record the following taxa (hereafter referred to as significant flora taxa) identified as
 occurring or potentially occurring within the Survey Area:
 - Threatened flora taxa (T) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
 - o Threatened flora taxa (T) listed under the WA Biodiversity Conservation Act 2016 (BC Act).
 - Priority flora taxa (P) classified by the WA Department of Biodiversity, Conservation and Attractions (DBCA).
 - Other significant flora taxa as defined by EPA (2016a, 2016b) (Section 3.10.1).
- Consult with experts at the WA Herbarium to endeavour to clarify the status of *Babingtonia* aff. *cherticola*, *Calytrix* aff. *eneabbensis* and *Stylidium carnosum* subsp. ?Narrow leaves (J.A. Wege 490) recorded by previous surveys in the vicinity of the Survey Area (specific recommendation from the gap analysis assessment prepared by Umwelt (2022c)).
- Identify locations of introduced vascular flora taxa, with particular focus on those that are Weeds of National Significance (WoNS), or Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act).
- Identify, map and describe Vegetation Types (VTs) that occur within the Survey Area, and undertake floristic analyses of quadrats established in the Survey Area with the entire Cooljarloo West quadrat dataset, to provide regional context.
- Identify, map and describe vegetation that occurs within the Survey Area that is one of the following (hereafter referred to as significant vegetation), to provide context for EIA:
 - Threatened Ecological Communities (TECs) listed under the Commonwealth EPBC Act and WA BC Act.
 - o Priority Ecological Communities (PECs) classified by DBCA.
 - Other significant vegetation as defined by EPA (2016a, 2016b) (Section 3.10.2).
- Map the condition of the vegetation in accordance with EPA (2016b).
- Identify potential groundwater dependent vegetation (GDV) and surface water dependent vegetation (SWDV) in the Survey Area.



1.4 Level of Assessment and Relevant Guidance

The flora and vegetation survey of the Survey Area involved a Detailed survey as defined in Section 4.3 of the *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b). This is considered appropriate for the Project, which is located in an area (the Northern Sandplains) that is known to support a high diversity of flora and vegetation relative to other areas of the State, including significant flora taxa and vegetation types (EPA, 2016b).

Targeted flora and vegetation surveys, as defined in Section 4.2 of the *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b), do not form part of this report; Targeted surveys have been undertaken in Spring 2023 and will be reported separately.

As discussed in **Section 1.1**, this survey builds on previous work conducted by Umwelt (as Woodman Environmental). The key results of relevant previous surveys are presented in **Section 5.1.3**.

The survey and reporting works comply with the following documents:

- Environmental Factor Guideline Flora and Vegetation (EPA, 2016a).
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

Considering the location of the Survey Area and known significant environmental values in the general vicinity of the Survey Area, several other guidance documents were considered in the context of the flora and vegetation survey, particularly in the context of the EPBC Act:

- Draft Survey Guidelines for Australia's Threatened Orchids (DAWE, 2013).
- Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (DoEE, 2016).
- Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (DoEE, 2019).
- Approved Conservation Advice for Clay Pans of the Swan Coastal Plain (DSEWPC, 2012).
- Methods for survey and identification of Western Australian Threatened Ecological Communities (DBCA, 2023c) (note that this latest version was released after completion of the field survey).



2.0 Background

2.1 Climate

The Survey Area is located with the SCP Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, specifically within the Perth IBRA subregion (SWA2), approximately 230 m from the junction with the Geraldton Sandplains IBRA bioregion / Lesueur Sandplain IBRA subregion (GES02) (DCCEEW, 2023a, 2023b). The SCP IBRA Bioregion (including the Perth IBRA Subregion) generally corresponds with the Drummond Botanical Subdistrict as defined by Beard (2015). The Drummond Botanical Subdistrict experiences a warm Mediterranean climate with predominantly winter rainfall (600 – 1,000 millimetres (mm) annually) and five to six dry months per year (Beard, 2015).

Graph 2.1 displays 2022 and long-term average monthly climate statistics at Bureau of Meteorology (BoM) weather stations closest and most relevant to the Survey Area; Badgingarra Research Station (mean monthly maximum temperature; station number 9037, long term data averaged from 1962-2022), and Dandaragan West (mean monthly precipitation; station number 9014, data from 1951-2022) (BoM, 2023a). **Graph 2.1** also presents 2022 and average monthly climate statistics collected at Tronox Cooljarloo site, from 1990 (precipitation) and 2015 (dry bulb maximum temperature) (Tronox, 2022, 2023).

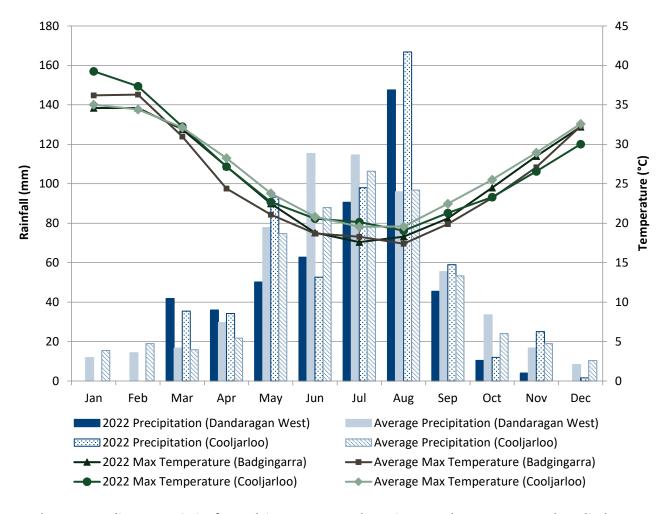
Long-term mean monthly maximum temperatures at Badgingarra Research Station peak in January and February (34.6 °C), while the lowest long-term monthly maximums are experienced in July (17.6 °C). Long-term mean monthly precipitation at Dandaragan West peaks from May to August (an average of 403.8 mm received during this period), with the greatest precipitation on average received in June and July (115.4 mm and 114.6 mm, respectively) and the least in December (8.3 mm). Annually, Dandaragan West receives an average of 590.6 mm of precipitation (**Graph 2.1**).

Temperature has been recorded at Cooljarloo for only seven years. During this period, maximum temperatures peak in January (39.3 °C) and are at their lowest in August (19.1 °C). Similarly to Dandaragan West station, precipitation at Cooljarloo peaks from May to August (an average of 366 mm received during this period), with the most precipitation typically received in July (106 mm) and the least in December (100 mm) (Graph 2.1).

Precipitation received at Dandaragan West in the three months prior to the survey (July to September 2022) (283.7 mm) was slightly higher than the long-term average for this period (266.1 mm), with above-average rainfall received during August 2022 (147.6 mm; 51.6 mm above the long-term average). At Cooljarloo, August 2022 was also particularly wet (167 mm; 70 mm above the long-term average), and precipitation received from July to September 2022 was also above average (324 mm compared to the average of 256 mm) (**Graph 2.1**).

The mean monthly maximum temperatures recorded at Badgingarra Research Station and Cooljarloo from July to September 2022 (18.8 °C and 20.2 °C, respectively) were similar to the averages for this period (18.5 °C and 20.5 °C, respectively) (**Graph 2.1**).





Graph 2.1 Climate Statistics for Badgingarra Research Station, Dandaragan West and Cooljarloo

2.2 Geology, Landform and Soils

As aforementioned, the Survey Area is located within the Perth IBRA subregion, near the junction with the Lesueur Sandplain subregion. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone (Mitchell et al., 2002). The Lesueur Sandplain subregion is comprised of coastal Aeolian and limestones, Jurassic siltstones and sandstones (often highly laterised) and alluvials associated with drainage systems (Desmond & Chant, 2002).

The Survey Area is situated on the Bassendean soil landscape zone (DPIRD, 2022a). The Bassendean zone consists of mid-Pleistocene Bassendean sand of fixed dunes inland from the coastal dune zone. The zone contains non-calcareous sands and podsolised soils with low-lying wet areas (Schoknecht et al., 2004).

Soil landscape mapping has been prepared across South-West WA by the Department of Agriculture (now the Department of Primary Industries and Regional Development (DPIRD)) as a compilation of the results of a variety of soil and soil-landscape surveys, considering general ecological information, vegetation physiognomy and composition, patterns of variation, conservation status, gradational association and land system representation (DPIRD, 2022b). Data from the North Coastal Plain Land Resources Survey has been used to map soil-landscape units in the region within which the Survey Area is located (Schoknecht et al., 2004).



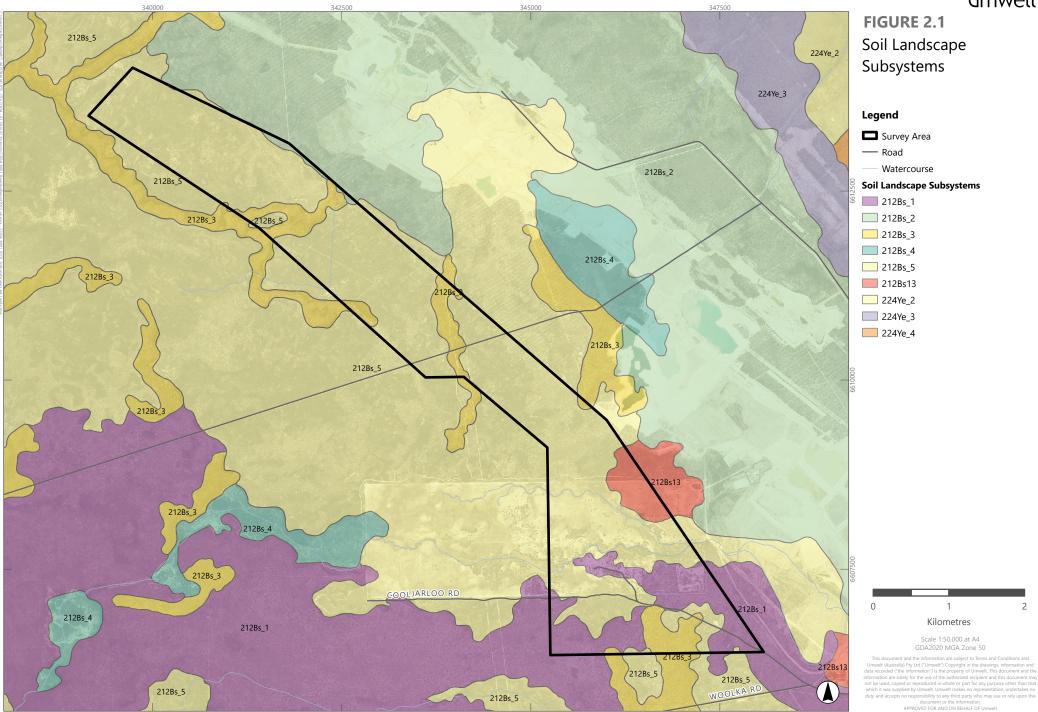
The Survey Area occurs across five soil landscape subsystems, as summarised in **Table 2.1** and presented in **Figure 2.1**; the dominant soil landscape subsystem (212Bs 5) is characterised by poorly drained plains, consisting of low rises or dunes interspersed with saline depressions and swamps (DPIRD, 2022b).

Table 2.1 Soil Landscape Subsystems of the Survey Area

Subsystem	Description	Mapped Extent in Survey Area (ha)
212Bs 1: Bassendean 1	Undulating to flat sandplain and minor swamps; pale to yellow deep sands	154
212Bs 2: Bassendean 2	Undulating sandplain (Similar to Bs1, but with ironstone and occasionally poorly drained depressions)	9
212Bs 3: Bassendean 3	Low dunefields; deep, pale grey or white sands	112
212Bs 5: Bassendean 5	Complex pattern of dunes or low sandy rises, poorly drained plains, (Complex of Bs1, Bs4 and Bs6; Bs4 or Bs6 dominant); saline depressions and swamps	1,005
212Bs 13: Bassendean 13	Relict alluvial plain; Grey or yellow/brown sandy duplexes and pale, yellow or brown deep sands	40

Source: Soil Landscape Mapping - Best Available (DPIRD-027) (DPIRD, 2022b).







3.0 Methods

3.1 Desktop Assessment Methods

Prior to commencement of the 2022 field survey, a review of all publicly available flora and vegetation data relevant to the Desktop Study Area was undertaken, as listed in **Table 3.1**; this includes data collated by Umwelt (2022c) for the Falcon West gap analysis. The desktop assessment included obtaining and reviewing copies of previous biological survey reports carried out within the vicinity of the Survey Area (those undertaken in compliance with current or previous EPA Technical Guidance), including via interrogation of the Index of Biodiversity Surveys for Assessments (IBSA) database. Where TECs or PECs were identified by the desktop assessment, appropriate DBCA or Department of Climate Change, Energy, the Environment and Water (DCCEEW) nomination/listing descriptions and recovery plans of the TEC or PEC were also reviewed prior to field survey, as well as the 'Methods for survey and identification of Western Australian threatened ecological communities' report from DBCA (2023c).

As listed in **Table 3.1**, the Tronox-Iluka database was also utilised to obtain sources of significant flora taxa occurring within the Desktop Study Area (data supplied by Iluka Resources Limited (Iluka), current at July 2021). The Tronox-Iluka database is a jointly managed database containing significant flora records, covering a large portion of the Northern Sandplains region and northern SCP sub-region.

Table 3.1 Searches Undertaken for the Desktop Assessment of the Survey Area

Source	Search Attributes	Search Purpose
BoM Groundwater Dependent Ecosystems Atlas (Moore–Hill rivers) (BoM, 2023b)	Database interrogated using Desktop Study Area boundary	Identify potential aquatic and terrestrial groundwater dependent ecosystems (GDEs) in the Desktop Study Area
Department of Agriculture, Water and the Environment (DAWE; now Department of Climate Change, Energy, the Environment and Water (DCCEEW)) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool) (DAWE, 2021, 2022)	Database interrogated using approximate Falcon West Study Area with a 10 km buffer. Search updated 30 September 2022 using Desktop Study Area boundary	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs listed under the EPBC Act, that occur or have the potential to occur within the Desktop Study Area
DBCA Significant Flora Databases (WA Herbarium Specimen Database and TPFL Databases) (DBCA, 2021b)	Database interrogated using Falcon West Desktop Study Area boundary. Search undertaken 30 September 2021, reference 86-0921FL	Obtain records of DBCA-listed significant flora within the Falcon West Desktop Study Area
DBCA NatureMap (WA Herbarium and Threatened and Priority Flora (TPFL) Databases) (DBCA, 2022a, 2007-2021)	Database interrogated using approximate Falcon West Study Area with a 10 km buffer. Search updated 16 December 2022 using Desktop Study Area boundary, reference 52-1222NM	Obtain records of DBCA-listed significant flora taxa within the Desktop Study Area (those within the area outside the Falcon West Desktop Study Area or those added to DBCA databases subsequent to the 2021 database interrogation)



Source	Search Attributes	Search Purpose
DBCA Threatened and Priority Ecological Communities Database (DBCA, 2021a)	Database interrogated using Falcon West Desktop Study Area boundary. Search undertaken 28 September 2021, reference 56-0921EC	Obtain records of DBCA-classified TECs and PECs within the Falcon West Desktop Study Area
DBCA TEC and PEC records spatial data (DBCA-038) (DBCA, 2022b)	Review of mapped DBCA TECs and PECs within or in proximity to the Desktop Study Area	Identify whether there are any DBCA classified TECs or PECs that could occur within the Desktop Study Area
DBCA TEC and PEC lists (DBCA, 2023d, 2023f)	Review of current DBCA TEC and PEC lists	Identify whether there are any additional DBCA-classified TECs or PECs that could occur within the Study Area
Directory of Important Wetlands in Australia (DBCA-045) (DBCA, 2018)	Desktop Study Area	Identify whether there are any Nationally Important Wetlands that occur within the Desktop Study Area
IBSA database (DWER, 2022)	Approximate Desktop Study Area boundary (exact boundary cannot be used)	Obtain copies of flora and vegetation reports and associated spatial data (where available), undertaken in compliance with current or previous EPA Technical Guidance, to identify records of significant flora and vegetation and introduced flora in the vicinity of the Survey Area
Tronox-Iluka Significant Flora Database (current at 16 June 2021) (Iluka, 2021)	Desktop Study Area	Identify records of significant flora taxa in the Desktop Study Area
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (DBCA, 2019) (Report 3b) and Pre-European Vegetation spatial database (DPIRD, 2019b)	Survey Area	Identify extent of Vegetation System Associations (pre-European vegetation mapping) within the Survey Area

3.2 Personnel and Licensing

Table 3.2 lists the personnel involved in fieldwork, plant identifications, data analyses and report preparation for the flora and vegetation assessment. The Project Manager and field team leaders have previous experience in all aspects of the assessment, including in conducting flora and vegetation surveys in the region. Other personnel have previous experience in assisting with flora and vegetation surveys in the region.

All plant material was collected under the relevant *Flora Taking (Biological Assessment) Licence* (under Regulation 62 of the Biodiversity Conservation Regulations 2018) and *Authorisation to Take or Disturb Threatened Species* (pursuant to Section 40 of the BC Act) as outlined in **Table 3.2**. Personnel reviewing plant identifications have had extensive previous experience in plant identifications of flora of the Geraldton Sandplains and checked plant identifications undertaken by less experienced personnel for accuracy.



Table 3.2 Personnel and Licensing Information

Personnel and Qualifications	Experience	Flora Collecting Licence/Permit	Role
David Coultas	> 15 years	FB62000051-2	Plant identifications and review
BSc (Environmental Biology) (Hons)		TFL 131-2122	Data analysis reviewReport review
Marlee Starcevich BSc (Environmental Science & Chemistry) (Hons)	> 7 years	FB62000056-2 TFL 155-2122	 Project management Desktop assessment Plant identifications Data analysis Vegetation mapping Report preparation
Marco Pratissoli PostGrad Dip Sc (Environmental Biology and Management)	4.5 years	FB62000057-2 TFL 143-1920	Detailed survey (field team leader)
Leah Firth BSc (Conservation Biology)	4 years	FB62000055-2 TFL 145-1920	Detailed survey (field team leader)Plant identificationsReport preparation
Glenn Stuckey BSc (Geography) & BA (Philosophy & Economics)	4 years	-	Detailed Survey
Charlotte Taunton BA (Communications & International Studies)	4 years	-	Detailed Survey
Kyler Rowson BSc (Marine Biology & Biological Sciences)	1.5 years	FB62000399	Detailed surveyPlant identifications
Georgia Johnsen BSc (Marine Biology & Conservation Biology)	< 1 year	FB62000470	Detailed surveyPlant identifications

3.3 Aerial Photograph Interpretation and Survey Design

The design of the 2022 survey complies with the requirements of EPA Technical Guidance (EPA, 2016b) and is consistent with the methods used for other similar flora and vegetation assessments conducted within the vicinity of the Survey Area (**Section 5.1.2**) and the wider south-west region.

As mentioned in Section 1.1, the area around and including the Survey Area has received considerable historical survey effort by Woodman Environmental (2014b) for the Cooljarloo West project, and a number of quadrats from that assessment occur within or in close proximity to the Survey Area. The results of that survey (with a focus on the flora and vegetation of the Survey Area) are summarised in Section 5.1.2.

Initial interpretation of ortho-rectified aerial photography at a scale of 1:10,000 was conducted to determine preliminary vegetation patterns present within the Survey Area (including any areas of restricted or unusual landforms and types). This review considered the size of vegetated areas, visible vegetation patterns, and previous vegetation mapping and quadrat density/locations in the Survey Area. Quadrat and



relevé locations were proposed based on this review to ensure that a minimum of three quadrats sampled each major discernible vegetation pattern and previously mapped VTs where possible; for smaller patterns/VTs, fewer quadrats and relevés were allocated based on the size of the pattern/VT polygon, while for widespread vegetation patterns/VTs, quadrats and relevés were allocated across their geographic range.

In addition, the data and associated report from the Cooljarloo West survey were reviewed during the desktop assessment (**Section 5.1.3**), and following completion of the field survey. This was necessary to resolve any taxonomic and nomenclature changes that have occurred since these sites were established and surveyed.

Data from existing quadrats located within the Survey Area, as well as from additional quadrats established in 2022, were utilised for the floristic analysis (see **Section 3.6**) and for building a taxon inventory for the Survey Area (see **Section 5.2.1**).

3.4 Field Survey Methods

3.4.1 Survey Timing and Access

The flora and vegetation field survey was undertaken over two site visits in 2022 as outlined below:

- 3rd to 7th October
- 17th to 21st October.

The timing of the field survey was selected to coincide with what is considered to be the most appropriate time to survey in the South West province; as per EPA Technical Guidance (2016b), this is spring (September to November), as most flora taxa in this region flower at this time. This includes the majority of significant flora taxa that potentially occur in the Survey Area (**Section 5.1.4**).

The Survey Area was accessed by vehicle using existing tracks and drill lines, and via foot traverses. Appropriate landholder/manager permissions were obtained prior to undertaking the field survey.

3.4.2 Sample Sites

A total of 60 flora and vegetation survey quadrats have been established in the Survey Area, as outlined below:

- 47 quadrats newly established in the Survey Area in 2022
- 13 quadrats established in the Survey Area by relevant previous surveys.

The quadrat size utilised for the survey is the indicative size for flora and vegetation surveys in the SCP IBRA Bioregion, as outlined in Table 1 of the EPA Technical Guidance (2016b). All quadrats measured 10 m × 10 m, encompassing a total area of 100 metres squared (m²). Quadrat boundaries were demarcated using handheld Global Positioning System (GPS) units and surveying tape measures. Quadrat locations were selected to ensure that at least three quadrats sampled each vegetation pattern initially identified from aerial photograph interpretation, where possible (as per **Section 3.3**). Vegetation boundaries or transition zones were avoided. Additional quadrats were established in areas that were not identified by the initial



aerial photograph interpretation but were observed in the field to differ from pre-identified areas, or areas of unusual habitat. The final quadrat locations were adjusted from the initial proposed locations where:

- variations in floristic patterning were observed, including placing additional quadrats in areas of unusual habitat
- the vegetation had been obviously recently disturbed
- the vegetation had been recently burnt (< 2 years) (where possible)
- access or safety issues were encountered.

All vascular flora taxa (native and introduced) that were visually identifiable within each quadrat were recorded. At least one reference specimen of most taxa encountered (excluding common, distinctive taxa) was collected for verification and identification purposes (see **Section 3.5**).

The following information was recorded at each quadrat:

- personnel
- unique quadrat number
- survey date
- GPS coordinates at start corner of quadrat (recorded using handheld GPS units) (Geocentric Datum of Australia 1994 (GDA94), Zone 50)
- size and dimensions of quadrat
- site photograph, taken diagonally into quadrat from start corner
- compass bearing for two sides of quadrat that commence at start corner of quadrat
- topography (including landform type and slope class)
- soil colour and type (including the presence and type of any rock outcropping and surface stones)
- vegetation condition (as per EPA Technical Guidance (2016b) for the South West and Interzone Botanical Provinces; scale presented in **Table 3.3**) and a description of disturbances (where relevant)
- approximate time since fire
- foliage cover (%) (for each taxon, native and introduced, including cover within the quadrat of individuals rooted outside the quadrat)
- height (m) (average for each taxon, native and introduced, excluding climbers/aerial shrubs)
- additional flora taxa present immediately outside the quadrat.

Flora and vegetation survey quadrats are not considered to be the most appropriate sampling method in all instances. Where areas of vegetation in relatively degraded condition are encountered, or if areas of vegetation are too small or narrow to allow for the establishment of quadrats (e.g. narrow road verges), the establishment and survey of relevés rather than quadrats is considered more appropriate. Relevés were



also established in vegetation patterns (in terms of areas mapped as Cooljarloo West VTs, and/or patterns identifiable via aerial photography interpretation) that had already been adequately surveyed by at least three quadrats.

Relevés surveyed an area within a radius of approximately 10 m around a central point. All data recorded for quadrats (as listed above) was also recorded for relevés; however, only dominant taxa of each stratum level were recorded, as well as any significant flora taxa or taxa not previously observed elsewhere. A total of 43 flora and vegetation survey relevés have been established in the Survey Area, of which 30 were surveyed during the 2022 field survey, as outlined below:

- 30 relevés newly established in the Survey Area in 2022
- 13 relevés established in the Survey Area by relevant previous surveys.

3.4.3 Vegetation Mapping Notes

Notes on vegetation pattern boundaries and distribution were also taken while traversing the Survey Area. These notes included a GPS location at the point where the notes were taken (GDA94, Zone 50), and a brief description of the vegetation, including dominant and characteristic taxa, vegetation condition, and landform information. The notes were used to aid in mapping polygons of vegetation patterns that were not surveyed by quadrats or relevés. Not all vegetation pattern polygons received quadrats or relevés; however, polygons could be relatively confidently allocated to a final VT using a combination of field mapping notes and aerial photograph interpretation. Changes in vegetation condition, and additional flora taxa (significant, opportunistic and introduced taxa) were also recorded opportunistically in the Survey Area during traverses between quadrats and relevés.

All traverses made during the 2022 field survey are mapped as track logs on **Figure 3.1**, along with quadrat, relevé and vegetation mapping note locations.

3.4.4 Opportunistic Survey for Significant Flora Taxa and Vegetation

A Targeted survey for significant flora taxa and vegetation, as defined in Section 4.2 of EPA Technical Guidance (2016b), did not form part of the 2022 survey; this assessment has been undertaken in Spring 2023 and will be reported separately. However, the majority of significant flora taxa and all vegetation communities identified by the desktop assessment were considered to be identifiable during the survey timing (Section 5.1.4), and therefore all taxa and vegetation were searched for opportunistically while traversing the Survey Area. As discussed in Section 3.4.2, any significant flora taxa present in quadrats and relevés were also recorded. Information relating to identifying characteristics, flowering period and habitat of these taxa, and relating to dominant taxa, soil and landform characteristics for significant vegetation, was provided to all field team members prior to undertaking the 2022 survey.

The following information was recorded during traverses of the Survey Area when significant flora taxa or vegetation were encountered opportunistically:

• location (including GPS coordinates and datum, recorded using handheld GPS units), taxon and count of any significant flora encountered at location within a radius of approximately 5 m from GPS coordinates



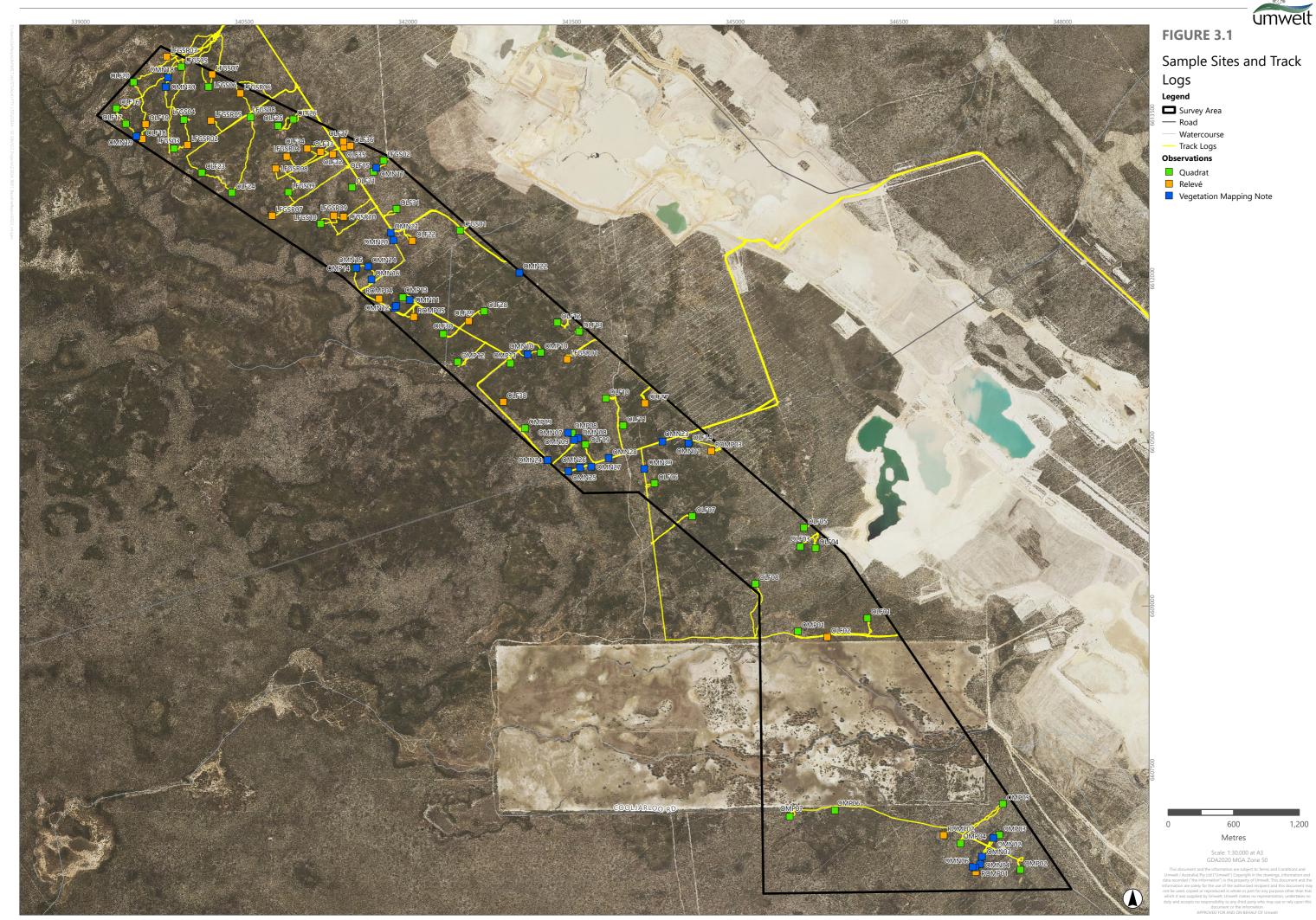
- location (including GPS coordinates and datum, recorded using handheld GPS units), community name and extent of any significant vegetation encountered within a radius of approximately 5 m from GPS coordinates
- comments on habitat, including landform and soils, dominant or characteristic taxa, vegetation condition, description of disturbances, and any apparent correlation between vegetation and landform features, as necessary.

If new locations of significant flora taxa were identified, a representative collection of material was made (see **Section 3.5**). Note that no counts of taxa were made where hitherto unknown significant flora taxa were identified from plant collections taken at quadrat/relevé locations or otherwise recorded opportunistically. Similarly, boundaries of hitherto unknown significant vegetation communities were not recorded during the field survey.

All traverses made during the 2022 field survey are mapped as track logs on Figure 3.1.

3.4.5 Introduced Flora Taxa

Opportunistic locations of introduced flora taxa encountered while traversing between quadrats and relevés were recorded using the same method as for significant flora taxa (Section 3.4.4), with particular emphasis given to WoNS and Declared Pests.





3.5 Plant Collection and Identification

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

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

As per section 7.2 of EPA Technical Guidance (2016b), specimens of interest, including significant flora taxa, taxa representing range extensions, potential new taxa, and key species in new occurrences of TECs and PECs, will be sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms (TPFRFs) submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (i.e. Threatened and Priority flora taxa).

3.6 Survey Area Floristic Classification Analyses

Floristic agglomerative hierarchical clustering analysis of data from quadrats established in the Survey Area (Section 3.4.2) was performed to inform the grouping of VTs. Two separate floristic analyses were undertaken in order to build an informed understanding of the VTs of the Survey Area, and to ensure that the addition of previously established quadrats sampled in different seasons did not confound the analysis results.

Floristic data from all historical quadrats were reviewed thoroughly for taxonomic currency (both in a nomenclature and conceptual context), with nomenclature updated where required (see **Section 5.2.1** for further details). A summary of the taxonomic and nomenclature updates to the Cooljarloo West quadrats included in the floristic analysis is presented in **Appendix A**.

The floristic classification analysis was undertaken by a botanist with considerable previous experience (> 7 years) in undertaking and interpreting floristic analysis results and was reviewed by a botanist with extensive previous experience (> 15 years) in analyses of the South West.

Taxa belonging to the below categories were removed prior to the classification analysis:

Annual/ephemeral taxa – the presence of annual or ephemeral taxa is strongly influenced by seasonal
conditions, and these taxa can be variably distributed across an area even after above-average rainfall.



Given floristic analyses were undertaken that included data collected over multiple years for the Cooljarloo West assessment, it is considered most appropriate to omit annual and ephemeral taxa, to minimise the risk of seasonal conditions influencing the analysis results.

- Introduced taxa introduced taxa were removed as their distributions are generally defined by the
 presence of disturbance (e.g. clearing, animal movement) rather than natural ecological drivers.
 Vegetation type must be determined independently of vegetation condition for the purposes of EIA;
 therefore, including weeds in the classification analysis introduces the risk of VTs allocated by the
 analysis being based on condition (presence/absence of introduced species) rather than native taxon
 presence/absence.
- Hybrids hybrids are usually the result of random reproductive events that produce small numbers (often only one) of sterile offspring and are often not associated with particular habitat types.
- Indeterminate taxa taxa were removed from the analysis where identification was unclear due to poor material available in the field. However, if such a taxon was known to be unique within the dataset (i.e. although not identifiable to species level, there was enough material to indicate it representing a unique taxon), and the taxon had multiple records in the dataset, it was included in the analysis (e.g. *Drosera* sp.).
- Singletons taxa that occur only once in the dataset were removed, as published studies indicate that they provide little information in the dataset; e.g. (Markey & Dillon, 2006).

All taxa removed from the classification analysis (excluding taxa belonging to the abovementioned categories) are presented in **Appendix B**. Also presented in **Appendix B** are taxa that were amalgamated in the classification analysis; this was done, for example, where different infra-taxa could not be consistently positively identified at all quadrats due to inadequate material.

In summary, two floristic classification analyses were undertaken to inform the grouping of VTs in the Survey Area, consisting of data as outlined below:

• Analysis one – 2022 quadrat data only:

- o 47 quadrats assessed in 2022 by this current survey (see **Section 3.4.2**)
- Dataset contained 157 taxa following the removal and/or amalgamation of the above-noted taxa.

Analysis two – 2022 and existing Survey Area quadrat data:

- 47 quadrats assessed in 2022 by this current survey
- o 13 quadrats assessed for the Cooljarloo West project that are located within the Survey Area
- o Dataset contained 168 taxa following the removal and/or amalgamation of the above-noted taxa.

Prior to undertaking agglomerative hierarchical clustering, a principal components analysis (PCA) using R Statistical Software (R Core Team, 2023) was undertaken on a single-layer data matrix consisting of presence/absence species data. Three analyses were then undertaken to determine the optimal number of clusters, with the minimum of these three metrics being considered to capture the majority of variation in the quadrat data:



- determining the "elbow" of the curve of a PCA scree plot and retaining all components before this point
- the point where the principal components contribute 5 % of the standard deviation and the principal components cumulatively contribute 90 % of the standard deviation
- the point where the percent change in variation between consecutive principal components is less than 0.1 %.

The same presence-absence data matrix was then used in the classification analysis, with the classification and ordination analysis of the data matrix undertaken using the 'vegan' (Oksanen et al., 2022) and 'cluster' (Maechler et al., 2022) R packages. The Bray-Curtis coefficient was used to generate an association matrix for the classification analysis. This association matrix consisted of pairwise coefficients of dissimilarities between quadrats based on floristic data. Agglomerative hierarchical clustering, using flexible Unweighted Pair Group Method with Arithmetic Mean (UPGMA) ($\beta = -0.1$), was used to generate a quadrat classification dendrogram using the 'factoextra' R package (Kassambara & Mundt, 2020).

A two-way table showing species presence in quadrats within clusters was also produced. Dissimilarity indices using the Bray-Curtis coefficient were generated for taxa as for quadrats, with the 'dendextend' R package (Galili, 2015) then used to split quadrats and taxa into clusters (as presented in the dendrogram). The 'pheatmap' package (Kolde, 2019) was subsequently used to produce the two way table.

In addition to the dendrogram, a cluster plot was generated using the 'factoextra' R package (Kassambara & Mundt, 2020). Prior to generating the cluster plot, PCA was performed to reduce the number of dimensions such that the data can be represented by clusters in a two-dimensional space. The data was then plotted according to the first two principal components that explain the majority of the variance in the dataset. This plot was utilised to assist in determining the feasibility of clusters and quadrat placement in the dendrogram.

3.7 Vegetation Type Definition, Mapping and Description

The classification analysis of the Survey Area floristic data aggregated quadrats and taxa into clusters according to the optimal number of cluster analysis (**Section 3.6**). The resulting dendrogram and two-way table were initially examined at this level to determine the plausibility of groups with regard to taxon groups, in combination with field observations. This process determined a final number of groups, which were considered to represent VTs.

Following this process, floristic and structural data recorded at relevés was examined to determine whether vegetation sampled by such relevés, such as in the case where vegetation condition may not support classification analysis, was analogous to any of the VTs defined by floristic composition classification. Any such vegetation that was not considered to be analogous with any of the VTs defined by floristic classification was considered to represent a discrete VT.

VT descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI, 2003), as stipulated by EPA Technical Guidance (2016b). The NVIS model follows nationally-agreed guidelines to describe and represent VTs, so that comparable and consistent data are produced nation-wide. It should be noted that the NVIS system utilises vegetation descriptions derived from structural characteristics of the individual community units, while VTs presented in this report are defined based on the results of a floristic classification analysis, excluding any structural



data. Such VTs therefore may include multiple structural types. Considering the effect of disturbance factors such as fire on vegetation structure, this approach is designed to provide a map of VTs that reflect taxon composition and the influences of the physical and chemical environment, rather than disturbance history.

It should also be noted that this report describes VTs at the NVIS Sub-Association level, rather than the Association level as recommended by EPA (2016b) for vegetation described at this scale. The Sub-Association level is considered more appropriate for the vegetation of the Survey Area, as often the vegetation possessed one or more additional strata to the traditional three-stratum classification system used at the Association level.

For each VT, indicator taxa were defined via Indicator Taxon Analysis (INDVAL). This was conducted using the 'labdsv' R package (Roberts, 2019) via the method of Dufrêne and Legendre (1997). This generates INDVAL values (a measure of taxon fidelity to a given VT) that range from 0 to 100; an INDVAL value of 100 indicates that a taxon is present in all quadrats within a particular VT and absent from all other quadrats included in the analysis. The INDVAL values were then tested for significance of the indicator taxa using a Monte Carlo permutation test. Indicator taxa were defined as taxa with a significance p value of either < 0.05, < 0.01 or < 0.001. The same taxa exclusions (i.e. annual/ephemeral taxa, introduced taxa and hybrids) and amalgamations (as per **Appendix B**) were employed for the indicator species analysis as per the Survey Area floristic classification analysis (**Section 3.6**). Note that only VTs sampled with more than one quadrat can be analysed for indicator species.

Locations of quadrats and/or relevés within each VT were used in conjunction with aerial photograph interpretation and field notes taken during the field survey to develop VT mapping polygon boundaries. Vegetation mapping notes from relevant previous surveys undertaken in the Survey Area were also reviewed during this process. Mapping boundaries were then developed using aerial photography at a maximum scale of 1:5,000 and reflected changes in vegetation patterns visible at this scale. The VT mapping polygon boundaries were then digitised using Geographic Information System (GIS) software.

3.8 Comparison of Vegetation Types with Cooljarloo West Vegetation Types

In addition to floristic analysis of quadrats located within the Survey Area as described in **Section 3.6**, a third floristic analysis was conducted using Cooljarloo West quadrat data, to provide regional context and assist with the identification of potentially significant vegetation in the Survey Area.

Data used for the analysis included floristic data from the Survey Area, and quadrats established within the wider Cooljarloo West Study Area for the Cooljarloo West project. Prior to undertaking the analyses, all floristic datasets were reviewed thoroughly for taxonomic currency (both in a nomenclature and conceptual context), with nomenclature updated where required. A summary of the taxonomic and nomenclature updates to the Cooljarloo West quadrats included in the floristic analysis is presented in **Appendix A**.

The methods of analysis used were the same as those described in **Section 3.6**, including taxa removed from/amalgamated in the analysis (presented in **Appendix B**), as well as cluster determination, dissimilarity index, and clustering methods. A summary of the analysis parameters and dimensions are outlined below:



Analysis three – 2022 and entire existing Cooljarloo West quadrat data:

- 47 quadrats assessed in 2022 by this current survey
- 13 quadrats assessed for the Cooljarloo West project that are located within the Survey Area
- 350 quadrats assessed for the Cooljarloo West project that are located within the wider Cooljarloo
 West Study Area
- dataset contained 390 taxa following the removal and/or amalgamation of the above-noted taxa.

The resulting classification dendrogram was reviewed to determine the position of Survey Area quadrats in relation to sites from the wider Cooljarloo West Study Area; from this, the relationships between Survey Area VTs and Cooljarloo West VTs were inferred, with particular attention on Cooljarloo West VTs that were identified by Woodman Environmental (2014b) to potentially represent significant vegetation. Additionally, species lists of Survey Area quadrats were compared to the typical species lists for Cooljarloo West VTs, as well as to individual Cooljarloo West quadrats species lists, soils, topography and geographical distribution data. The aim of this process was to validate the outcomes of the classification analysis.

It is important to note that the original quadrat groupings that formed the basis of the original Cooljarloo West VTs are not maintained in the resultant dendrogram. A changing of relationship between quadrats from the analysis originally conducted for the Cooljarloo West study is to be expected due to addition of new data to the dataset, as well as taxonomic changes relating to taxa in the area, necessitating changes to the original quadrat data. As a result, there is inherent ambiguity in inferences made from examination of the dendrogram alone.

Following the above process, data recorded at relevés and vegetation mapping notes in the Survey Area (from the 2022 and Cooljarloo West surveys), including floristic, structural, soil, landform and hydrological status characteristics information, was manually examined to determine whether vegetation sampled by such sites was analogous to any Cooljarloo West VTs.

3.9 Vegetation Condition Mapping

Vegetation condition was described using the vegetation condition scale presented in EPA Technical Guidance (2016b) for the South West and Interzone Botanical Provinces (as per **Table 3.3**). Notes on vegetation condition were taken during the field survey via vehicle traverses along access tracks, and during foot traverses undertaken within the Survey Area. Vegetation condition was also recorded at all quadrats and relevés. Vegetation condition category polygon boundaries were developed using this information in conjunction with introduced flora taxa location data and were digitised using GIS software as for VT polygon boundaries.



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

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

Source: Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

3.10 Significant Flora and Vegetation Definitions

3.10.1 Significant Flora Taxa

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

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

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



Conservation codes for State-listed taxa are described by DBCA (2023b). Further information about Commonwealth conservation categories is provided in Threatened Species Scientific Committee's (TSSC) 'Guidelines for assessing the conservation status of native species according to the *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000' (TSSC, 2021).

3.10.2 Significant Vegetation

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

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

To determine the presence of TECs and PECs defined from quadrat-derived data, EPA Technical Guidance (2016b) requires comparison of quadrat data with that of the survey from which the TEC or PEC was originally described. However, limited information is often available for TECs and PECs; generally, only broad descriptions are provided in the respective TEC and PEC lists to allow for diagnosis. The vegetation of the Survey Area was therefore manually compared to such descriptions to determine whether any vegetation may represent a TEC or PEC; specifically, comparisons of dominant taxa, soils, topography and geographical distribution of VTs were made to those of any relevant TEC or PEC. A similar process was followed for TECs listed under the EPBC Act, with comparisons made to the appropriate listing and conservation advice for any TECs likely to occur in the Survey Area. The DBCA publication 'Methods for survey and identification of Western Australian threatened ecological communities' (DBCA, 2023c) was also reviewed for TECs listed under the BC Act.

The remaining significant vegetation criteria other than "being identified as a TEC and PEC" were applied to VTs mapped in the Survey Area to determine whether a VT was significant in a local or regional context. In a regional context, reference has been made to the extent of VTs mapped by Woodman Environmental (2014b) for the Cooljarloo West project (Section 3.8).

Definitions, categories and criteria for WA TECs and PECs are available from DBCA (2023a). Further information about Commonwealth conservation categories is provided in TSSC's 'Guidelines for nominating and assessing the eligibility for listing of ecological communities as threatened according to the *Environment Protection and Biodiversity Conservation Act 1999* and the EPBC Regulations 2000' (TSSC, 2017)).



4.0 Adequacy and Limitations of Survey

4.1 Adequacy of Survey

The Survey Area covers 1,320 ha, with 60 quadrats established within it during the 2022 field survey or relevant previous surveys. Quadrats were established in all preliminary vegetation patterns discernible by initial aerial photograph interpretation (**Section 3.3** and **Section 3.4.2**), both to sufficiently sample variation in vegetation throughout the Survey Area, and to ensure adequacy of sampling for vascular plant taxa.

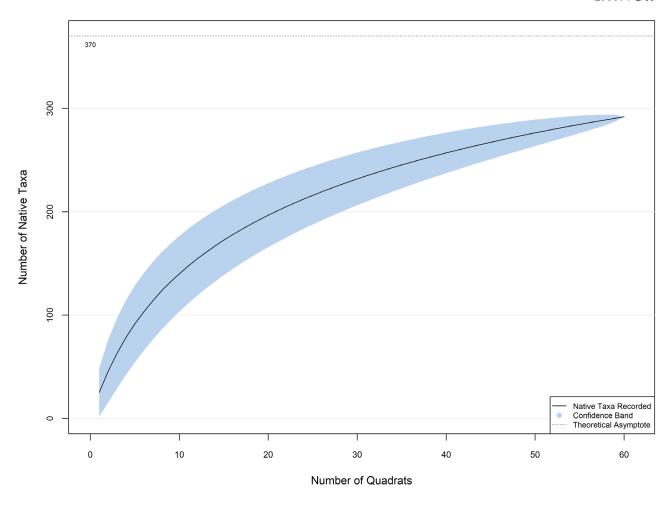
The number of quadrats established in the Survey Area is considered to be acceptable given the size of the Survey Area and the diversity of topography and soil types, with approximately 1 quadrat established per 22 ha of Survey Area.

To provide an indication of the adequacy of this survey, a native taxon accumulation curve was produced with the 'vegan' R package (Oksanen et al., 2022) using R Statistical Software (R Core Team, 2023). Taxon accumulation curves represent a theoretical model of the relationship between sampling intensity and taxon accumulation; when sampling intensity is increased, taxon accumulation is reduced, and the taxon accumulation curve becomes asymptotic.

The taxon accumulation curve for quadrat data in the Survey Area was generated using all native taxa (both annual and perennial) recorded within each quadrat. Taxon accumulation calculations were then undertaken using the 'SpadeR' R package (Chao et al., 2016), utilising the Chao-2 estimator for species richness (bias corrected form) (Chao, 1987) and compared to the actual number of taxa recorded in the Survey Area. The results were then visualised on a graph using base R. This provides an indication as to whether sufficient quadrats were surveyed to adequately sample the species richness in the Survey Area. As the generation of taxon accumulation curves includes quadrat data only, and not opportunistically recorded taxa or taxa recorded at relevés, the indication of adequacy of survey is considered to be conservative.

Graph 4.1 presents the native taxon accumulation curve generated from quadrat data from the Survey Area (those newly established in 2022 and established previously for the Cooljarloo West assessment). Using the Chao-2 estimator, the recorded number of native taxa within quadrats (292 taxa) is equivalent to 79 % of the estimated native taxon richness in the Survey Area (370 native taxa estimated to occur), indicating that it was relatively well sampled. However, it is worthy of note that when native taxa recorded at relevés, mapping notes and opportunistically are taken into account, 380 taxa have been recorded in the Survey Area by the 2022 assessment and Cooljarloo West Survey.





Graph 4.1 Survey Area Quadrat Data Native Taxon Accumulation Curve

Another adequacy of survey measure is that developed by Mueller-Dombois & Ellenberg (1974), who suggest that a cut-off point might be when a 10 % increase in quadrats surveyed results in a \leq 5 % increase in taxa recorded. This measure was also calculated using all native flora taxa recorded within each quadrat. The number of quadrats established in the Survey Area satisfies this adequacy measure, with a final taxon increase value of 2.9 % recorded following a 10 % increase in quadrats.

4.2 Assessment of Limitations

Table 4.1 presents an assessment of potential limitations of the flora and vegetation assessment in accordance with EPA Technical Guidance (2016b). There are no limitations that are considered to have significantly impacted the results of the assessment of the Survey Area.



 Table 4.1
 Limitations of the Flora and Vegetation Survey of the Survey Area

Limitation	Determination	Comment
Effort and extent	Not a limitation	A Detailed Survey was undertaken across the entire Survey Area over 20 team days. Overall, 57 quadrats and 43 relevés have been established in the Survey Area, of which 47 and 30, respectively, were surveyed in 2022. The number of sample sites is considered adequate to characterise the flora and vegetation of the Survey Area, with at least three quadrats allocated to each vegetation pattern identified pre-survey, with the exception of VTs D-C and W-B. These two VTs were mapped across very few occurrences and very small extents, thus preventing replication of quadrats/relevés within them. Adequacy of survey measures indicate that the Survey Area was well sampled, and it is considered that there was no limitation in terms of detailed survey extent. Systematic Targeted survey for significant flora taxa identified by the desktop assessment was not conducted during the 2022 survey. Opportunistic targeted survey for significant flora taxa was undertaken while traversing the Survey Area to establish quadrats and relevés. Targeted Survey for significant flora was undertaken in Spring 2023 (methods and results to be reported separately).
		No constraints prevented appropriate sampling techniques (quadrat/relevé establishment, foot traverses) being employed. Most areas were relatively easy to access using available access tracks/drill lines. Data reliability is therefore considered to be relatively high.
Competency / experience of the team carrying out the survey	Not a limitation	The Project Manager has previous experience (> 6 years) in conducting similar assessments in the SCP Bioregion and conducting systematic sampling and analysis. The Project Director has > 15 years of experience in conducting similar assessments at Cooljarloo and within the wider SCP Bioregion, and provided guidance during the field, plant identification, analyses, vegetation mapping, and reporting components. Field team leaders have previous experience (> 4 years) in conducting flora and vegetation surveys in the SCP Bioregion, and field team personnel have previous experience assisting in flora and vegetation surveys. Senior personnel provided guidance to less experienced botanists throughout the survey where necessary. Information relating to identifying characteristics, flowering period and habitat of significant flora taxa identified by the desktop assessment as potentially occurring in the Survey Area was provided to all field team members prior to
		undertaking the 2022 field survey, and all field personnel observed in situ locations of significant flora taxa known to occur in the Survey Area prior to surveys commencing.
		Personnel overseeing plant identifications have > 15 years' experience in plant identification in flora of the SCP Bioregion. Relevant taxonomic experts (including botanists at the WA Herbarium) were consulted for any specimens considered to be difficult to identify or of taxonomic interest.



Limitation	Determination	Comment
Proportion of flora recorded and/or collected and identified	Not a limitation	All vascular groups that were present in the Survey Area were sampled. At least one reference specimen of all taxa encountered (excluding common, distinctive taxa) was collected for verification and identification purposes during the 2022 field survey.
		Both site visits for the 2022 field survey were conducted within what is generally considered to be the ideal time to survey in the SCP Bioregion (September to November). Precipitation received in the three months prior to these site visits was above average (Section 2.1). It is considered likely that the majority of flora taxa were detectable and identifiable during the survey.
		All unknown vascular taxa were collected and could be positively identified.
		Adequacy of survey measures indicate that the Survey Area was well sampled (Section 4.1).
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Not a limitation	Good contextual information for the Survey Area was available prior to the 2022 field survey. Sources of information used included government databases (DCCEEW, DBCA) and numerous general sources pertaining to the climate, geomorphology, and flora and vegetation of the SCP Bioregion, all of which are considered to have high reliability. Previous reports and data from the vicinity of the Survey Area as summarised in Section 5.1.2 are also considered to be generally reliable unless where stated.
		Review of Bureau of Meteorology (BoM) climate data for Dandaragan West, Badginarra and Lancelin stations revealed a small number of gaps in the daily datasets for temperature and precipitation; however, this data was used in an indicative manner only, and therefore this is not considered to be a limitation of this survey.
Survey timing and weather/season/cycle	Not a limitation	The survey was conducted in October, corresponding with what is considered to be the optimum time to survey in the SCP Bioregion (Spring). The 2022 flowering period was considered by the Umwelt field team to be good, with above average rainfall received in
		the three months prior to the survey (July to September; Graph 2.1).
Disturbances (e.g. fire, flood, accidental human intervention etc.) that may have affected results of survey	Not a limitation	As is to be expected, vegetation fringing roads and tracks showed minor signs of disturbance, such as minor changes to vegetation structure and slightly greater presence of weeds. This did not affect the detectability or identifiability of significant flora taxa or vegetation, or determination of VTs, and is therefore not considered to be a limitation of the survey.
Remoteness and/or access restrictions	Not a limitation	There were no access-related constraints, with all areas of native vegetation being relatively easily accessible by vehicle and foot using roads and tracks, allowing high intensity of sampling across the Survey Area.



5.0 Results

5.1 Desktop Assessment

5.1.1 Regional Vegetation

The Survey Area is located within the Perth IBRA subregion (SWA2), near the junction with the Lesueur Sandplain subregion (GES02) (DCCEEW, 2023a, 2023b). The Perth subregion is a low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah (*Eucalyptus marginata*) woodland. The outwash plains, once dominated by *Casuarina obesa-Corymbia calophylla* (Marri) woodlands and Melaleuca shrublands, are extensive only in the south (Mitchell et al., 2002). The Lesueur Sandplain subregion comprises shrub-heaths rich in endemics on a mosaic of lateritic mesas, sandplains, coastal sands and limestones. Heath occurs on lateritised sandplains along the subregion's north-eastern margins (Desmond & Chant, 2002).

The vegetation of WA as it was presumed to have existed prior to European settlement has been mapped at a scale of 1:250,000 as vegetation system associations (VSAs), with the pre-European Vegetation spatial database subsequently created (Beard et al., 2013; DPIRD, 2019b). The Survey Area occurs within the Bassendean 1030 VSA, with the south-eastern corner of the Survey Area being approximately 330 m west of the boundary with the Lesueur 1031 VSA. A summary of information relating to these two VSAs is presented in **Table 5.1**, including the current extent of each VSA in relation to its pre-European extent within the respective IBRA subregion, and the percentage of the current extent of each VSA currently protected for conservation within the respective IBRA subregion (DBCA, 2019). Note that as per DBCA's Statewide Vegetation Statistics Report (DBCA, 2019), protected areas in this context are considered to be any areas listed in DBCA-Legislated Lands and Waters dataset as either Crown reserves or lands managed under Section 8A of the *Conservation and Land Management Act 1984* that have an International Union for Conservation of Nature (IUCN) category of I to IV.

The Bassendean 1030 VSA has almost 70 % of its pre-European extent remaining within the Perth IBRA subregion, however less than 14 % of the current extent within the subregion is protected for conservation. The Lesueur 1031 VSA has much less of its pre-European extent remaining within the Lesueur IBRA subregion (33 %), but a greater proportion of the current extent is protected (almost 40 %) (**Table 5.1**).

Table 5.1 Bioregional Statistics of Vegetation System Associations of the Study Area

VSA	Description	Proportion of Survey Area (%)	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent Protected for Conservation (%)
Bassendean 1030	Low woodland; Banksia attenuata and Banksia menziesii	100	79,561	69.7	13.9
Lesueur 1031	Mosaic: Shrublands; Hakea scrub-heath / Shrublands; Banksia heath	0 (330 m west)	73,457	32.7	37.8

Source: DBCA Statewide Vegetation Statistics: Full Report (DBCA, 2019).



5.1.2 Local Flora and Vegetation Surveys

Numerous flora and vegetation surveys have been undertaken over many years in the Cooljarloo area. The search of the EPA database returned five relevant flora and vegetation assessments, while the search of the IBSA website did not return any assessments that had the associated report or survey data uploaded to the database. A further 21 assessment reports from previous surveys undertaken by Umwelt (including those as Woodman Environmental), or from reports supplied to Umwelt, were reviewed. In addition, reports from monitoring of rehabilitation at the Tronox Cooljarloo site were reviewed, as the rehabilitation methodology includes application of local topsoil and mulch material, and therefore the rehabilitation contains propagules of taxa from the local area.

A summary of the results of flora and vegetation surveys undertaken in the ten years prior to preparation of the Falcon West gap analysis desktop assessment (i.e. since 2011) is presented in **Table 5.2**. Where required, taxon nomenclature and conservation status of taxa from surveys listed in **Table 5.2** have been updated in line with Florabase (WA Herbarium, 1998-), which provides the most up-to-date information regarding the conservation status of flora taxa in WA. Therefore, taxa that have been delisted since preparation of these survey reports are not included in the numbers of significant flora taxa presented in **Table 5.2**.

The locations of the surveys summarised in **Table 5.2** are shown on **Figure 5.1** (subject to the availability of survey boundary files).

The following significant flora taxa were recorded by survey(s) listed in **Table 5.2** but have since had their taxonomy updated or are likely misidentifications and cannot be confidently resolved. These taxa are therefore not included in **Table 5.2** or discussed further in this report:

- Chordifex chaunocoleus (P4) a review of the concepts of Chordifex chaunocoleus and Chordifex reseminans resulted in all Northern Sandplains material of the former being re-identified as the latter. Therefore, Chordifex chaunocoleus is not considered to occur in the area.
- Cyanothamnus tenuis (P4) presented in Woodman Environmental (2014b), as Boronia tenuis (P4). This taxon is likely to have been historically mis-identified, as no specimen associated with this record has been vouchered at the WA Herbarium (1998-), the taxon has not been recorded by surveys in the area, and it is unlikely that habitat for the taxon is present (Umwelt field observations).
- Desmocladus microcarpus (P2) the purported records of this taxon in the Desktop Study Area have been determined to be misidentifications of Desmocladus nodatus (P3). Desmocladus microcarpus is only known from upland, lateritic habitats (WA Herbarium, 1998-).
- Diuris ?eburnea (P1) presented in Woodman Environmental (2014b). The identification of this entity has been updated to Diuris laxiflora, which is not listed as significant.
- Goodenia perryi (P3) presented in Mattiske (2017) and Woodman Environmental (2014b). Does not occur in the area according to DBCA databases (WA Herbarium, 1998-). Umwelt has previously searched for this taxon at the historical locations without success, and it is considered that these records likely represent a misidentification of Goodenia coerulea, which is not listed as significant.
- *Hibbertia helianthemoides* (P4) presented in Woodman Environmental (2014b). This taxon is known from a restricted extent in and in close proximity to Stirling Range National Park



(WA Herbarium, 1998-), and therefore is not considered to occur in the area. At the time of preparation of the Falcon West gap analysis, there were two records of this taxon in the Cooljarloo area on NatureMap (DBCA, 2007-2021) (which is updated less frequently than Florabase, and has since been taken offline indefinitely), but both of these records originate from Threatened and Priority Flora Report Forms from observations made in 2002, and no specimens of this taxon from the area have been submitted to the WA Herbarium (WA Herbarium, 1998-). It is considered possible that the purported records of *Hibbertia helianthemoides* (P4) actually represent misidentifications of *Hibbertia sericosepala*, which was published as a new species in 2013 (Thiele, 2013).

Ornduffia submersa (P4) – presented in Mattiske (2017) and Woodman Environmental (2014b). Does
not occur in the area according to DBCA databases (WA Herbarium, 1998-), and is likely a
misidentification of Liparophyllum capitatum, which is not listed as significant.

In addition, the following taxa may represent misidentifications, and require further investigation to confirm their validity. These taxa are presented in **Table 5.2** as a precaution:

- Babingtonia cherticola (P3) (presented in **Table 5.2** as 'Babingtonia aff. cherticola (potentially undescribed)') specimens collected from the Cooljarloo area that were identified as Babingtonia cherticola (P3) have since been revised to Babingtonia aff. cherticola (WA Herbarium, 1998-). The paper within which Babingtonia cherticola (P3) was described stated that western specimens of this taxon (i.e. Babingtonia aff. cherticola) tend to have the hypanthium less obviously pitted and have fewer stamens and ovules, although there is some overlap in all these characters (Rye, 2015). Further study is required to determine whether the western populations warrant recognition as a distinct.
- Calytrix aff. eneabbensis presented in Mattiske (2017) and Woodman Environmental (2014b). This taxon may represent a misidentification, but further investigation is required to confirm this.
- Frankenia glomerata (P4) DBCA databases indicate that there are no records of this taxon in the Cooljarloo area (WA Herbarium, 1998-). However, this taxon has been previously recorded by Umwelt west of Cooljarloo (Woodman Environmental, 2015a), and it is possible that habitat for the taxon is present in the area.
- Haloragis foliosa (P3) DBCA databases indicate that there are no records of this taxon in the Cooljarloo area (WA Herbarium, 1998-); however, it is possible that habitat for this taxon is present.
- Hypocalymma gardneri (P3) DBCA databases indicate that there are no records of this taxon in the Cooljarloo area (WA Herbarium, 1998-). The records of this taxon in the local area are from surveys conducted in 2008.
- Stylidium carnosum subsp. ?Narrow leaves (J.A. Wege 490) material of this entity collected from the Cooljarloo area was identified as this by Stylidium expert Juliet Wege. It is unclear why identification to subspecies level was considered to be tentative, and as this collection has not appeared in the Herbarium's collection according to Florabase (WA Herbarium, 1998-), despite being submitted to the WA Herbarium by Umwelt, it is not possible to determine whether the identification has since been confirmed. If so, this record fills a distribution hole for Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490).
- Stylidium maritimum (P3) DBCA databases indicate that there are no records of this taxon in the Cooljarloo area (WA Herbarium, 1998-); however, it is possible that habitat for this taxon is present.



Table 5.2 Summary of Results of Flora and Vegetation Surveys Previously Conducted Within and in the Vicinity of the Survey Area

Project and Source	Location	Survey Timing	Scope and Parameters of Survey			Significant Flora Taxa
Northern Operations Cooljarloo: Assessment of the Impacts of Mulch Harvesting on Floristic Composition of Native Vegetation (Woodman Environmental, 2011)	Immediately east of Survey Area (shares a border)	October 2010	Vegetation monitoring in areas harvested for mulch for use in rehabilitation. 96 monitoring quadrats: 72 in mulched areas, 24 in non-harvested areas. Targeted flora survey in select, previously mulched areas	259 taxa (250 native) 130 genera 44 families	6 plant communities described and mapped. No TECs or PECs identified	7 Priority taxa
Flora Assessment of Drill Lines in Cooljarloo West, Cooljarloo North West and Cooljarloo South West (Mattiske, 2012)	Partly intersects Survey Area, the rest extending to northwest and southeast	September to November 2011	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed, but no TECs or PECs identified	3 Threatened taxa 7 Priority taxa
Atlas Tenement Level 2 Flora and Vegetation Survey – North Perth Mineral Sands Project (Single Phase) (360 Environmental, 2012)	Approx. 7.9 km northwest of Survey Area	October to November 2011	Detailed flora and vegetation survey. 28 quadrats assessed over 957 ha	364 taxa (318 native)	13 vegetation units described and mapped. No TECs or PECs identified	9 Priority taxa
Targeted Flora Search of Additional Exploration Access Lines Cooljarloo West (Astron, 2012)	Partly intersects Survey Area, the rest extending to southeast	December 2012	Targeted flora survey along drill lines	NA	NA	1 Threatened taxon 1 Priority taxon
Cooljarloo North Mine: Search of Mine Path for Conservation Significant Flora (Woodman Environmental, 2013)	Immediately east of Survey Area (shares a border)	September to October 2013	Targeted flora survey	NA	NA	1 Priority taxon



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Botanical Survey of 2013 Exploration Access Lines Cooljarloo (Astron, 2013)	Partly intersects Survey Area, the rest extending to south and southeast	October to November 2013	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed, but no TECs or PECs identified	5 Priority taxa
Waddi Wind Farm Spring Flora and Vegetation Survey and Black Cockatoo Habitat Survey (Outback Ecology, 2014)	Approx. 5 km east of Survey Area	October to November 2013	Reconnaissance and Targeted flora and vegetation survey. 15 relevés assessed	191 taxa (183 native) 98 genera 38 families	8 vegetation units described and mapped. 2 units identified as being of conservation significance (Banksia woodland and Kwongan (Proteaceous Heath))	6 Priority taxa
Botanical Survey of 2014/2015 Cooljarloo Drill and Access Lines (Woodman Environmental, 2014a)	Approx. 1.9 km southwest of Survey Area	October to December 2013	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed, but no TECs or PECs identified	2 Threatened taxa 2 Priority taxa
Cooljarloo West Titanium Minerals Project Flora and Vegetation Assessment (Woodman Environmental, 2014b)	Survey Area within Woodman Environmental study area	September to November 2012 and May 2013. Incorporating quadrat data previously collected in October to November 2006, March 2008 and October 2010	Detailed flora and vegetation survey incorporating existing data from previous work. 363 quadrats assessed over 34,424 ha	1,156 taxa (1,063 native) and 1 putative hybrid 318 genera 86 families	19 VTs described and mapped. No TECs or PECs identified. 16 VTs ranked as having 'High' or 'Very High' conservation significance due to restricted distribution and providing habitat for significant flora	5 Threatened taxa 53 Priority taxa 2 potentially undescribed taxa



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Botanical Survey of 2015 Cooljarloo Drill and Access Lines (Woodman Environmental, 2015a)	Survey Area, the rest extending to November 2014 vegetation survey along drill lines		NA	Vegetation not assessed, but no TECs or PECs identified	3 Threatened taxa 18 Priority taxa	
Cooljarloo North Mine: Mine Path Threatened Flora Survey (Woodman Environmental, 2015b)	Multiple study areas; closest approx. 580 m east of Survey Area		NA	NA	1 Threatened taxon	
Exploration Environmental Assessment 2016: Desktop Review, Field Survey and Impact Assessment (Woodman Environmental, 2016)	Partly intersects Survey Area, the rest extending to northwest and southeast	October 2015	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed, but no TECs or PECs identified. One VT ranked as having 'Very High' conservation significance recorded	5 Threatened taxa 3 Priority taxa
Conservation Significant Flora Survey and Impact Assessment, Tronox Cooljarloo West Project (Mattiske, 2017)	Partly intersects Survey Area, the rest extending to south	July to December 2016	Targeted flora survey. Ground truthing of VT boundaries	NA	VTs groundtruthed and minor changes made to VT mapping	4 Threatened taxa 41 Priority taxa 2 potentially undescribed taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2017: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Woodman Environmental, 2017a)	Partly intersects Survey Area, the rest extending to southeast	November 2016	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified	1 Threatened taxon 6 Priority taxa



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Second Phase Flora and Vegetation Survey: EP 447 R1 – North Perth Basin, Walyering (360 Environmental, 2017a)	Approx 3.6 km east of Survey Area	August 2016	Targeted flora and vegetation survey	NA	6 vegetation associations and 4 vegetation units described and mapped. 1 TEC identified	3 Priority taxa
Threatened & Priority Flora and Vegetation: EP 447 R1 (360 Environmental, 2017b)	Approx 3.6 km east of Survey Area	November 2016	Targeted flora and vegetation survey	56 taxa 34 genera 14 families	6 vegetation associations and 4 vegetation units described and mapped. 1 TEC identified	5 Priority taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2018: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Woodman Environmental, 2018b)	Partly intersects Survey Area, the rest extending to northeast and southeast	August 2017 October 2017	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified. 1 VT ranked as having 'Very High' conservation significance recorded	1 Threatened taxon 8 Priority taxa
Cooljarloo Mineral Sands Mine: Survey of Vegetation Polygons for Threatened Flora Taxa (Woodman Environmental, 2017c)	Multiple study areas; closest approx. 1.3 km east of Survey Area	October 2017	Targeted flora survey	NA	NA	No significant flora taxa recorded
Further Survey for Significant Flora Taxa: Cooljarloo Area, Including Meadows Road Fire Area (Woodman Environmental, 2018c)	Multiple study areas surrounding Survey Area; closest surveyed approx. 5.8 km to west	October 2017	Targeted flora survey	NA	NA	3 Threatened taxa 4 Priority taxa



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Brand Highway Passing Lanes Survey for Listed Threatened and Priority Flora Taxa (Woodman Environmental, 2018a)	Multiple survey areas; most relevant approx. 5.2 km east of Survey Area	November 2017	Targeted flora survey	NA	NA	Relevant survey areas only (survey areas 3, 4 and 5): 13 Priority taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2019: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Woodman Environmental, 2019)	Partly intersects Survey Area, the rest extending to northeast and southeast	October 2018	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified. 3 VTs ranked as having 'Very High' conservation significance recorded	1 Threatened taxon 12 Priority taxa
Raven 2D Seismic Surveys Ecological Assessment (Strategen, 2020)	Partly intersects Survey Area, the rest extending to southwest	November 2019	Reconnaissance and Targeted flora and vegetation survey. Ground truthing of VT boundaries	NA	13 VTs ground truthed. Minor boundary changes made for the following reasons: • newly cleared areas • availability of higher resolution aerial imagery • where field observations differed from mapping data. 1 TEC identified	3 Threatened taxa 15 Priority taxa



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2021: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Woodman Environmental, 2021)	Partly intersects Survey Area, the rest extending to north and southeast	October 2020	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified. 2 VTs ranked as having 'Very High' conservation significance recorded	1 Threatened taxon 10 Priority taxa
2020 Rehabilitation Reference Plot Monitoring: Northern Operations – Cooljarloo (Umwelt, 2022a)	Partly intersects Survey Area, the rest extending to north and southeast	October to November 2020	Survey of Dry Woodland (VTs 17 and 18) and Wet Heath (VTs 1, 5 and 9a) baseline reference plots for rehabilitation program. 30 plots assessed	304 taxa (296 native) 141 genera 50 families	Vegetation not assessed – existing VT mapping from Woodman Environmental (2014b) utilised	13 Priority taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2022: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Umwelt, 2022b)	Partly intersects Survey Area, the rest extending to north and southeast	October 2021	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified. 2 VTs ranked as having 'Very High' conservation significance recorded	13 Priority taxa
Cooljarloo Exploration Area Exploration Environmental Assessment 2023: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Umwelt, 2023)	Partly intersects Survey Area, the rest extending to north and southeast	August 2022 October 2022	Targeted flora and vegetation survey along drill lines	NA	Vegetation not assessed. 1 TEC identified. 1 VTs ranked as having 'Very High' conservation significance recorded	2 Threatened taxa 15 Priority taxa



Project and Source	Location	Survey Timing	Scope and Parameters of Survey	Number of Taxa Recorded	Vegetation	Significant Flora Taxa
Annual Tronox Cooljarloo rehabilitation monitoring (data from Woodman Environmental/Umwelt, 2001-)	Multiple locations north, east and southeast of Survey Area	Spring 2001 to present	Monitoring of rehabilitation and targeted flora surveys within rehabilitation	NA	NA	3 Threatened taxa 21 Priority taxa







5.1.3 Known Vegetation Values of the Survey Area

The vegetation of the Survey Area and surrounds has been previously described by Woodman Environmental (2014b) for the Cooljarloo West project (**Figure 5.2**). This survey is the most recent large-scale Detailed flora and vegetation assessment to have been undertaken in the Cooljarloo area; the study involved floristic analysis of data from 370 quadrats surveyed between 2006 and 2012 over an area of 32,424 ha (hereafter referred to as the 'Cooljarloo West Study Area'/CWSA). A total of 18 VTs (including one VT split into two subgroups) were defined and mapped over the Cooljarloo West Study Area.

The Survey Area, which is entirely contained in the Cooljarloo West Study Area, contains 13 quadrats and 13 relevés from the Cooljarloo West survey and intersects 10 Cooljarloo West VTs, as summarised in **Table 5.3**. Also included in **Table 5.3** is the conservation significance of these VTs as per Woodman Environmental (2014b); this was determined following consideration of the extent of the VT in the Cooljarloo West Study Area, whether the VT occurs on restricted landforms, and whether the VT provides habitat for significant flora taxa. The regional representation of the Cooljarloo West VTs intersected by the Survey Area is also summarised in **Table 5.3**, including the potential presence of the VTs in conservation reserves. Note that Woodman Environmental also indicated potential correlations of VTs with Gibson et al. (1994) SCP floristic community types (FCTs); however, the Cooljarloo West Study Area is located outside the geographic range of the Gibson et al. study (and the subsequent supplementary vegetation dataset from Keighery et al. (2012)), and therefore there are inherent difficulties with comparing vegetation from the Cooljarloo West survey and the aforementioned studies on the southern SCP. This is discussed further in **Section 5.2.7.2**.

Descriptions of all 19 Cooljarloo West VTs is presented in **Appendix C**. Note that taxon nomenclature in **Table 5.3** and **Appendix C** has been updated where required.

While two adequacy of survey measures (the same as those described in **Section 4.1**) indicated that the Cooljarloo West Study Area was adequately sampled, Woodman Environmental (2014b) stated that a number of VTs were difficult to interpret in the field and/or from aerial photography, without the confidence of quadrat data (e.g. VTs 17 and 18). In addition, time and access-related constraints prevented sampling in some vegetation patterns. Mattiske (2017) undertook ground-truthing via field observations of Cooljarloo West VT boundaries within the Mattiske (2017) survey area, revising polygon boundaries in situ to redefine large (generally > 50 m) discrepancies with the VT mapping boundaries. Only areas that were obviously different based on structural (woodland versus heath or low shrubland) and wet (i.e. Super-group 1) versus dry (i.e. Super-group 2) VTs were changed. Some obvious changes were made to 'islands', usually small polygons originally mapped as VT 17 or VT 18 (Super-group 2; drier landscape positions) and enclosed by VT 1 or VT 5 (Super-group 1; wetter landscape positions). These were identified in the field by Mattiske botanists as Melaleuca spp. shrublands in swampy low-lying areas and were therefore reallocated to VT 9a. Other changes to VT boundaries involved extensions or reductions, mostly to VT 1 and VT 5 boundaries (leading to minor changes to the area of surrounding polygons). The largest differences were made to VT 1 (an increase of 22 ha in the Mattiske (2017) survey area) and VT 17 (a decrease of 23 ha). Habitat associations for significant flora taxa were also further refined (Mattiske, 2017). Additional ground-truthing undertaken by Strategen (2020) also identified that some minor changes to the Cooljarloo West VT mapping were required; this was done where there were newly cleared areas and where field observations differed from mapping data. Other general changes were also made due to the availability of higher resolution aerial imagery; however, spatial data incorporating these changes is not available.



Table 5.3 Cooljarloo West VTs Intersected by the Survey Area

VT	Description*	Proportion of Survey Area (%)	Proportion of CWSA (%)*	Conservation Significance*	Regional Representation*
1	Low Open Heathland to Mid Closed Heathland of Acacia lasiocarpa var. lasiocarpa, Banksia telmatiaea, Melaleuca seriata, Hakea obliqua subsp. parviflora, Regelia ciliata and/or Verticordia densiflora var. densiflora, often with Mid Isolated Clumps of Shrubs to Mid Sparse Shrubland of Melaleuca rhaphiophylla on white-grey to grey-brown sand, sandy loam or sandy clay in broad damp depressions on flat to gently undulating plains	24.7	12.1	 Moderate: Occupies > 10 % of CWSA Not restricted in CWSA Contains preferred habitat for Threatened flora 	Possible equivalent/similar vegetation in Moore River National Park and Namming Nature Reserve
2	Mid Sparse Shrubland to Mid Closed Shrubland of Melaleuca acutifolia, Melaleuca brevifolia, Melaleuca rhaphiophylla and/or Melaleuca viminea subsp. viminea over Low Isolated Clumps of Shrubs to Low Shrubland of Calothamnus hirsutus, Calothamnus sanguineus and Grevillea cooljarloo (P1) on grey to grey-brown sand, sandy loam or sandy clay in broad damp to wet depressions and drainage lines on flat to gently undulating plains	4.2	3.1	 High Occupies < 10 % of CWSA Moderately restricted in CWSA Contains preferred habitat for Threatened flora 	Possible equivalent/similar vegetation in Eneminga Nature Reserve
5	Low Heathland to Mid Closed Heathland of Banksia telmatiaea, Hakea obliqua subsp. parviflora, Melaleuca seriata and/or Regelia ciliata on white-grey to grey-brown sand, sandy loam, sandy clay or clay loam in broad damp depressions on flat to gently undulating plains	7.1	5.5	 High Occupies < 10 % of CWSA Contains preferred habitat for Threatened flora 	Possible equivalent/similar vegetation in Moore River and Nambung National Parks and Namming Nature Reserve



VT	Description*	Proportion of Survey Area (%)	Proportion of CWSA (%)*	Conservation Significance*	Regional Representation*
6	Low Isolated Clumps of Trees to Low Woodland of Banksia attenuata, Banksia menziesii and/or Banksia ilicifolia over Low Sparse Shrubland to Mid Closed Shrubland of Adenanthos cygnorum subsp. cygnorum, Banksia telmatiaea, Beaufortia squarrosa, Hypocalymma balbakiae, Jacksonia nutans and/or Melaleuca seriata over Low Isolated Clumps of Sedges to Mid Sedgeland of Anarthria laevis and/or Low Isolated Clumps of Rushes of Chordifex sinuosus on whitegrey to grey-brown sand in damp depressions	1.1	1.0	 Very High Occupies < 1 % of CWSA Restricted in CWSA Provides habitat (but not preferred) for Threatened flora 	Possible equivalent/similar vegetation in Eneminga and Namming Nature Reserves and on Bassendean Sands (including in State Forest)
7	Low Sparse Heathland to Low Closed Heathland of Allocasuarina spp., Calothamnus quadrifidus, Calothamnus sanguineus, Hakea incrassata, Hakea lissocarpha, Hibbertia crassifolia and/or Melaleuca seriata over Low Isolated Clumps of Sedges to Mid Sparse Sedgeland of Mesomelaena pseudostygia and Schoenus clandestinus on white-grey to grey sand or white-grey sandy loam to yellow-brown clay loam with lateritic surface stones in broad dry depressions or gently undulating plains	1.3	1.2	 High Occupies < 10 % of CWSA Moderately restricted in CWSA Provides habitat (but not preferred) for Threatened flora 	Possible equivalent/similar vegetation in Badgingarra National Park, Minyulo Nature Reserve and unnamed Reserve 27216
9a	Mid Open Shrubland to Tall Closed Shrubland of Melaleuca teretifolia, Melaleuca rhaphiophylla and Melaleuca viminea subsp. viminea, occasionally with Mid Shrubs of Melaleuca lateritia and Low to Tall Sedges and Rushes of Machaerina juncea, Chorizandra enodis, Leptocarpus coangustatus and Schoenus subfascicularis on grey to grey-brown sandy loam or clay loam in broad shallow basins, wet flats and drainage lines	0.1	0.8	 Very High Occupies < 1 % of CWSA Restricted in CWSA Located on a very restricted landform (claypan) 	Possible equivalent/similar vegetation in Unallocated Crown Land (UCL) north and south of CWSA



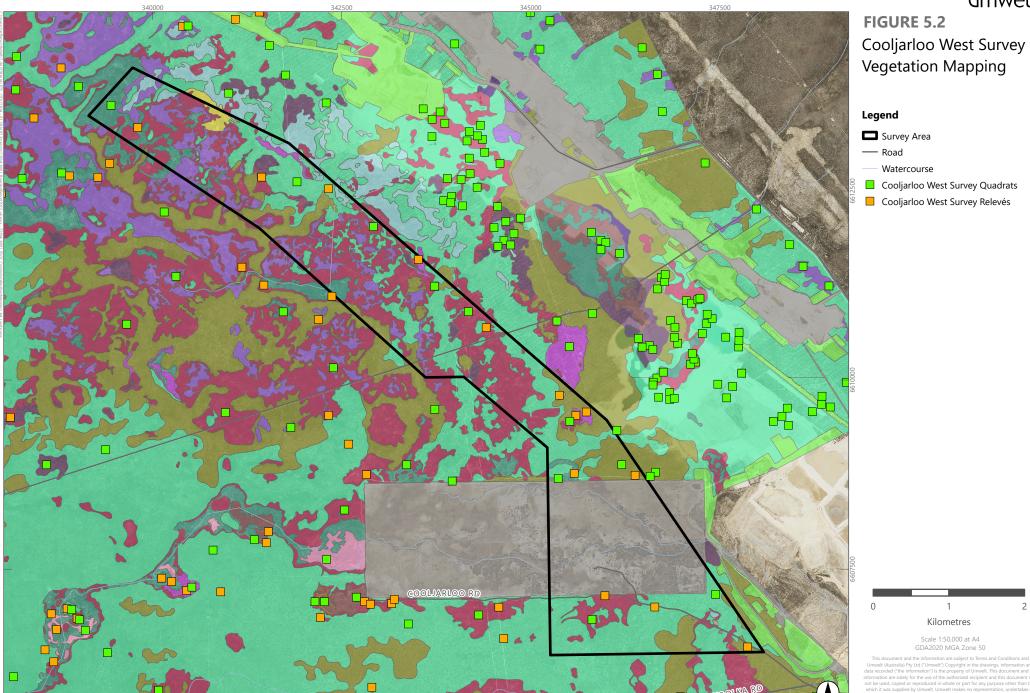
VT	Description*	Proportion of Survey Area (%)	Proportion of CWSA (%)*	Conservation Significance*	Regional Representation*
9b	Low Woodland to Mid Open Forest of <i>Eucalyptus rudis</i> subsp. <i>rudis</i> over Low Isolated Clumps of Trees to Low Closed Forest of <i>Melaleuca rhaphiophylla</i> , often with Tall Sparse Shrubland to Tall Shrubland of <i>Acacia saligna</i> subsp. Wheatbelt (B.R. Maslin 8602), over Low Isolated Clumps of Forbs to Low Closed Forbland of * <i>Galium murale</i> , * <i>Hypochaeris glabra</i> , * <i>Lysimachia arvensis</i> and <i>Trachymene pilosa</i> on grey to greyblack sand, sandy loam, sandy clay or clayey sand in wetlands, broad shallow basins/depressions and drainage lines	0.9	0.8	 Very High Occupies < 1 % of CWSA Restricted in CWSA Provides habitat (but not preferred) for Threatened flora 	Possible equivalent/similar vegetation in Lancelin Defence Training Area and sometimes on Bassendean Sands (including some areas in Nature Reserves)
12	Tall Shrubland to Tall Closed Shrubland of Acacia saligna ?subsp. Wheatbelt (B.R. Maslin 8602) and Melaleuca rhaphiophylla over Low Isolated Clumps of Sedges to Mid Open Sedgeland of Lepidosperma ?longitudinale on grey sand to dark brown loamy sand with ironstone outcropping in shallow basins	0.6	0.04	 Very High Occupies < 1 % of CWSA Highly restricted in CWSA Located on a very restricted landform (claypan/ironstone) 	No possibly equivalent regional vegetation identified
17	Low Isolated Clumps of Trees to Low Open Forest of Banksia attenuata, Banksia menziesii and Eucalyptus todtiana over Mid Isolated Clumps of Shrubs to Mid Shrubland of Adenanthos cygnorum subsp. cygnorum, Eremaea pauciflora, Jacksonia floribunda, Jacksonia nutans, Stirlingia latifolia and Xanthorrhoea preissii over Low Isolated Clumps of Shrubs to Low Shrubland of Bossiaea eriocarpa, Dasypogon obliquifolius, Eremaea asterocarpa subsp. asterocarpa, Eremaea pauciflora, Hibbertia crassifolia, Hibbertia hypericoides, Jacksonia nutans, Melaleuca clavifolia, Patersonia occidentalis var. ?occidentalis and Petrophile linearis over Low Isolated Clumps of Sedges to Mid Open Sedgeland of Mesomelaena pseudostygia on white or grey sand on undulating plains and low dunes	28.9	47.6	 Moderate Occupies > 10 % of CWSA Not restricted within CWSA Contains preferred habitat for Threatened flora 	Possible equivalent/similar vegetation in Moore River National Park, Namming, Bundarra and Wanagarren Nature Reserves, Lancelin Defence Training Area and on Bassendean Sands (including in State Forest and Nature Reserve)



VT	Description*	Proportion of Survey Area (%)	Proportion of CWSA (%)*	Conservation Significance*	Regional Representation*
18	Low Isolated Clumps of Trees to Low Open Forest of Banksia attenuata and Banksia menziesii over Mid Isolated Clumps of Shrubs to Mid Shrubland of Allocasuarina humilis, Conospermum stoechadis subsp. stoechadis, Eremaea pauciflora, Hakea costata and/or Xanthorrhoea preissii over Low Isolated Clumps of Shrubs to Low Closed Shrubland of Bossiaea eriocarpa, Calothamnus sanguineus, Dasypogon obliquifolius, Eremaea pauciflora, Hibbertia hypericoides, Jacksonia nutans and/or Melaleuca clavifolia over Low Isolated Clumps of Sedges to Mid Open Sedgeland of Mesomelaena pseudostygia on grey to yellow-grey sand on undulating plains and low dunes or white-grey to grey-brown sand, sandy loam or sandy clay loam on simple slopes, open depressions or flats within undulating plains	10.6	18.4	 Moderate Occupies > 10 % of CWSA Not restricted within CWSA Contains preferred habitat for Threatened flora 	Possible equivalent/similar vegetation in Moore River National Park, Namming and Wanagarren Nature Reserves, Lancelin Defence Training Area and on Spearwood and Bassendean Sands (including in Crown Land)

^{*} Source: Cooljarloo West Titanium Minerals Project Flora and Vegetation Assessment (Woodman Environmental, 2014b).







Legend Cooljarloo West Survey VTs 1 Low open heathland to mid closed heathland of Acacia lasiocarpa var. lasiocarpa, Banksia telmatiaea, Melaleuca seriata, Hakea obliqua subsp. parviflora, Regelia ciliata and/or Verticordia densiflora var. densiflora, often with mid isolated clumps of shrubs to mid sparse shrubland of Melaleuca rhaphiophylla on white grey to grey brown sand, sandy loam or sandy clay in broad damp depressions on flat to gently undulating plains Mid sparse shrubland to mid closed shrubland of Melaleuca acutifolia, Melaleuca brevifolia, Melaleuca rhaphiophylla and/or Melaleuca viminea subsp. viminea over low isolated clumps of shrubs to low shrubland of Calothamnus hirsutus, Calothamnus sanguineus and Grevillea cooljarloo (P1) on grey to grey brown sand, sandy loam or sandy clay in broad damp to wet depressions and drainage lines on flat to gently undulating plains Low isolated clumps of shrubs of Regelia ciliata and Kunzea glabrescens or mid shrubland of Verticordia densiflora var. densiflora over low isolated clumps of forbs of *Hypochaeris glabra and Trachymene pilosa on white grey sandy clay or grey brown sand on the periphery of claypans 5 Low heathland to mid closed heathland of Banksia telmatiaea, Hakea obliqua subsp. parviflora, Melaleuca seriata and/or Regelia ciliata on white grey to grey brown sand, sandy loam, sandy clay or clay loam in broad damp depressions on flat to gently undulating plains 6 Low isolated clumps of trees to low woodland of Banksia attenuata, Banksia menziesii and/or Banksia ilicifolia over low sparse shrubland to mid closed shrubland of Adenanthos cygnorum subsp. cygnorum, Banksia telmatiaea, Beaufortia squarrosa, Hypocalymma balbakiae, Jacksonia nutans and/or Melaleuca seriata over low isolated clumps of sedges to mid sedgeland of Anarthria laevis and/or low isolated clumps of rushes of Chordifex sinuosus on white grey to grey brown sand in damp depressions Low sparse heathland to low closed heathland of Allocasuarina spp., Calothamnus quadrifidus, Calothamnus sanguineus, Hakea incrassata, Hakea lissocarpha, Hibbertia crassifolia and/or Melaleuca seriata over low isolated clumps of sedges to mid sparse sedgeland of Mesomelaena pseudostygia and Schoenus clandestinus on white grey to grey sand or white grey sandy loam to yellow brown clay loam with lateritic surface stones in broad dry depressions or gently undulating plains 9a Mid open shrubland to tall closed shrubland of Melaleuca teretifolia, Melaleuca rhaphiophylla and Melaleuca viminea subsp. viminea, occasionally with mid shrubs of Melaleuca lateritia and low to tall sedges and rushes of Machaerina juncea, Chorizandra enodis, Leptocarpus coangustatus and Schoenus subfascicularis on grey to grey brown sandy loam or clay loam in broad shallow basins, wet flats and drainage lines 9b Low woodland to mid open forest of Eucalyptus rudis subsp. rudis over low isolated clumps of trees to low closed forest of Melaleuca rhaphiophylla, often with tall sparse shrubland to tall shrubland of Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602), over low isolated clumps of forbs to low closed forbland of *Galium murale, *Hypochaeris glabra, *Lysimachia arvensis and Trachymene pilosa on grey to grey black sand, sandy loam, sandy clay or clayey sand in wetlands, broad shallow basins/depressions and drainage lines 10 Low isolated clumps of trees to mid woodland of Banksia littoralis and Melaleuca preissiana over tall isolated clumps of shrubs to Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602) and Viminaria juncea over mid sparse shrubland to mid shrubland of Hypocalymma balbakiae and Xanthorrhoea preissii over low open sedgeland to mid sedgeland of Machaerina juncea, Cyathochaeta avenacea and/or Lepidosperma longitudinale on grey to grey black loamy sand in drainage lines, wet plains and edges of damp depressions 12 Tall shrubland to tall closed shrubland of Acacia saligna ?subsp. Wheatbelt (B.R. Maslin 8602) and Melaleuca rhaphiophylla over low isolated clumps of sedges to mid open sedgeland of Lepidosperma ?longitudinale on grey sand to dark brown loamy sand with ironstone outcropping in shallow basins 16 Low sedgeland of Chaetospora curvifolia and/or low isolated clumps of forbs to low closed forbland of *Dittrichia graveolens, *Lysimachia arvensis, Pogonolepis stricta, *Parentucellia viscosa, Brachyscome bellidioides, Calandrinia sp. Kenwick (G.J. Keighery 10905), Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634) and Wurmbea sp. on grey to grey brown sandy clay loam on non-saline flats 17 Low isolated clumps of trees to low open forest of Banksia attenuata, Banksia menziesii and Eucalyptus todtiana over mid isolated clumps of shrubs to mid shrubland of Adenanthos cygnorum subsp. cygnorum, Eremaea pauciflora, Jacksonia floribunda, Jacksonia nutans. Stirlinaia latifolia and Xanthorrhoea preissii over low isolated clumps of shrubs to low shrubland of Bossiaea eriocarpa, Dasypoaon obliquifolius. Eremaea asterocarpa subsp. asterocarpa, Eremaea pauciflora, Hibbertia crassifolia, Hibbertia hypericoides, Jacksonia nutans, Melaleuca clavifolia, Patersonia occidentalis var. ?occidentalis and Petrophile linearis over low isolated clumps of sedges to mid open sedgeland of Mesomelaena pseudostvaia on white or grey sand on undulating plains and low dunes 18 Low isolated clumps of trees to low open forest of Banksia attenuata and Banksia menziesii over mid isolated clumps of shrubs to mid shrubland of Allocasuarina humilis, Conospermum stoechadis subsp. stoechadis, Eremaea pauciflora, Hakea costata and/or Xanthorrhoea preissii over low isolated clumps of shrubs to low closed shrubland of Bossiaea eriocarpa, Calothamnus sanguineus, Dasypogon obliquifolius, Eremaea pauciflora, Hibbertia hypericoides, Jacksonia nutans and/or Melaleuca clavifolia over low isolated clumps of sedges to mid open sedgeland of Mesomelaena pseudostygia on grey to yellow grey sand on undulating plains and low dunes or white grey to grey brown sand, sandy loam or sandy clay loam on simple slopes, open depressions or flats within undulating plains Cleared land Rehabilitation area

FIGURE 5.2

LEGEND: Cooljarloo West Survey Vegetation Mapping

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5.1.4 Significant Flora Taxa

The interrogation of the DBCA WA Herbarium (WA Herb) Specimen and TPFL Databases (DBCA, 2021b) returned a total of 65 DBCA-listed significant vascular flora taxa that have records in the Falcon West Desktop Study Area. Of these, six taxa are listed as Threatened under the EPBC Act or BC Act, while the remaining 59 taxa are DBCA-classified Priority flora taxa. Five taxa returned from the DBCA TPFL and WA Herbarium database interrogations have records known from within the Survey Area, being *Isopogon panduratus* subsp. *palustris* (P3), *Lepyrodia curvescens* (P2), *Macarthuria keigheryi* (T), *Schoenus pennisetis* (P3) and *Stylidium longitubum* (P4).

The DCCEEW (then DAWE) SPRAT database was initially interrogated in 2021 using the Falcon West Study Area with a 10 km buffer, and was updated prior to the 2022 field survey using the Desktop Study Area. The 2021 SPRAT database interrogation identified that 16 Threatened flora taxa (or habitat for such taxa) may occur in the interrogation area, while the 2022 search returned an additional taxon from the wider search area (DAWE, 2021, 2022). However, 10 of these taxa have not been previously recorded in the area according to DBCA databases (DBCA, 2021b, 2022a). This is likely because the SPRAT database search results are based on Threatened flora data from regional areas rather than actual flora records (as per the DBCA database searches); it therefore includes provision of species and species habitat that are 'likely to occur', 'may occur', as well as 'known to occur'. Therefore, it returns flora taxa over a wider area than the DBCA database searches. The full results of the 2021 and 2022 DCCEEW database searches are presented in **Appendix D**.

An interrogation of DBCA databases using NatureMap (NM) (DBCA, 2022a, 2007-2021) was also undertaken in 2021 and 2022, to check for any recently added records and confirm the records returned from the 2021 DBCA WA Herbarium Specimen and TPFL Database searches. The NatureMap searches returned 12 additional listed significant flora taxa.

Note that *Chordifex chaunocoleus* (P4), *Cyanothamnus tenuis* (P4) and *Hibbertia helianthemoides* (P4) were returned from the DBCA TPFL and NatureMap database interrogations (DBCA, 2021b, 2022a, 2007-2021), but as discussed in **Section 5.1.2**, these taxa do not occur in the area according to Florabase (WA Herbarium, 1998-). Therefore, these taxa are not discussed further in this report, and records of *Chordifex chaunocoleus* (P4) are presumed to actually represent *Chordifex reseminans* (P2).

The 2021 NatureMap search (DBCA, 2007-2021) also returned *Calytrix eneabbensis* (P4) and *Grevillea thelemanniana* (T); however, according to Florabase (WA Herbarium, 1998-), the specimens that represent these particular records are now noted as being *Calytrix* aff. *eneabbensis* and *Grevillea cooljarloo* (P1) (previously *Grevillea* sp. Cooljarloo (B.J. Keighery 28 B)), respectively. *Grevillea cooljarloo* (P1) is known from the area and was returned by the DBCA database searches; this result has therefore been updated to this nomenclature in this report. However, *Calytrix eneabbensis* (P4) does not occur in the area according to DBCA databases (WA Herbarium, 1998-) and Umwelt field observations. Further investigation is required to confirm the taxonomy and significance of the record of *Calytrix* aff. *eneabbensis* in the Desktop Study Area. Therefore, it has been included in this desktop assessment as a precaution.

Appendix E presents a summary of significant flora taxa known from or potentially occurring within the Desktop Study Area. This list has been compiled from the results of desktop searches of DBCA's Threatened Flora Databases (TPFL and WA Herbarium) (DBCA, 2021b, 2022a, 2007-2021), DCCEEW's SPRAT Database (DAWE, 2021, 2022), the Tronox-Iluka Significant Flora Database (Iluka, 2021), and the results of previous surveys as summarised in **Section 5.1.2**. **Appendix E** also presents information on the flowering period and



habitat for each taxon according to specimens lodged at the WA Herbarium (accessed via Florabase) (WA Herbarium, 1998-).

A total of 105 significant flora taxa are known from or have the potential to occur within the Desktop Study Area. This comprises:

- 18 Threatened flora taxa listed under the EPBC Act or BC Act
- 85 DBCA-classified Priority flora taxa
- two potentially undescribed taxa (Appendix E).

Of the 105 taxa identified by the desktop assessment, 22 have records within the Survey Area. Note that taxa with incomplete identifications (e.g. *Stylidium ?hymenocraspedum*) have not been presented in **Appendix E** if there are records of that taxon with complete identification (i.e. *Stylidium hymenocraspedum*) in the Desktop Study Area.

Figure 5.3 presents the known historical locations of significant flora taxa within the Desktop Study Area (subject to the availability of spatial data).



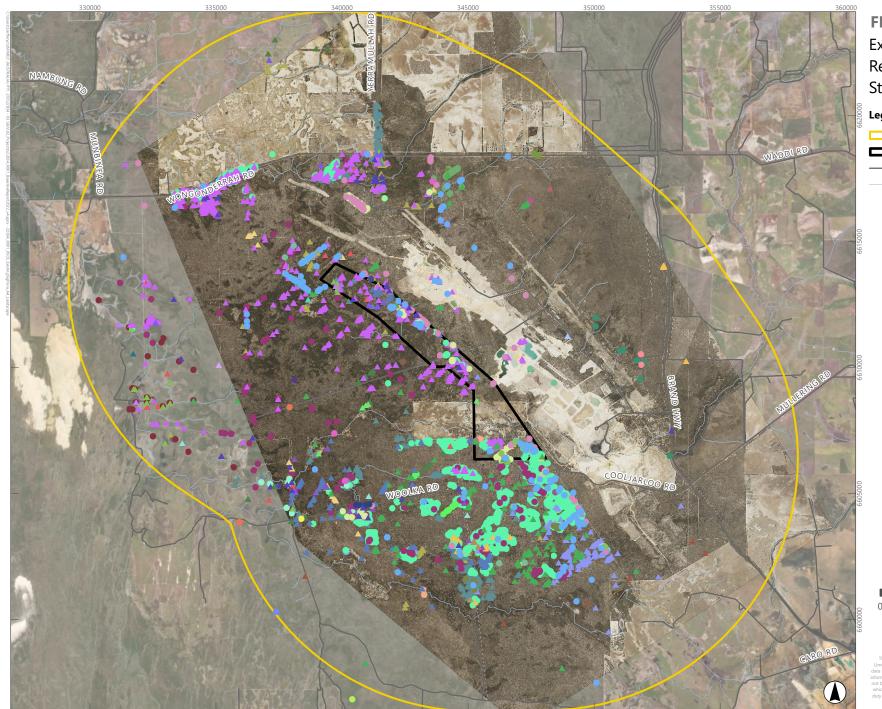


FIGURE 5.3

Existing Significant Flora Records in the Desktop Study Area

Legend

Desktop Study Area

Survey Area

--- Road

Watercourse

0 3 6
Kilometres

Scale 1:150,000 at A4 GDA2020 MGA Zone 50

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Legend Significant Flora Taxa Jca Jacksonia carduacea (P3) Lcu Abe Acacia benthamii (P2) Lepyrodia curvescens (P2) Allocasuarina grevilleoides (P3) Leucopogon sp. Yanchep (M. Hislop 1986) (P3) LspY Agr Andersonia gracilis (T) Lyginia excelsa (P2) Lex Angianthus micropodioides (P3) Macarthuria keigheryi (T) Mke Anigozanthos humilis subsp. chrysanthus (P4) Ahuc Pdix Paracaleana dixonii (T) Anigozanthos viridis subsp. terraspectans (T) Persoonia rudis (P3) Pru Avit Ppip Anigozanthos viridis subsp. ?terraspectans (T) Phlebocarya pilosissima subsp. pilosissima Arnocrinum gracillimum (P3) Pra Platysace ramosissima (P3) Babingtonia aff. cherticola (potentially Poranthera asybosca (P1) Bur Babingtonia urbana (P3) Poranthera moorokatta (P2) Bdap Banksia dallanneyi subsp. pollosta (P3) Sgr Schoenus griffinianus (P4) Spe Bbi Beaufortia bicolor (P3) Schoenus pennisetis (P3) Ssu Ber Beaufortia eriocephala (P3) Stenanthemum sublineare (P2) Bcic Beyeria cinerea subsp. cinerea (P3) Sac Stylidium aceratum (P3) Caladenia denticulata subsp. albicans (P1) Saeo Cdea Stylidium aeonioides (P4) Calectasia palustris (P2) Shy Stylidium hymenocraspedum (P3) Сра ▲ Chch Chordifex chaunocoleus (P4) S?hy Stylidium ?hymenocraspedum (P3) Cre Chordifex reseminans (P2) Slo Stylidium longitubum (P4) Comesperma rhadinocarpum (P3) Crh Tap Thelymitra apiculata (P4) Csc Conospermum scaposum (P3) ▲ Tpu Thelymitra pulcherrima (P2) Cma Conostephium magnum (P4) Tgl Thysanotus glaucus (P4) Dbi Desmocladus biformis (P3) Vhut Verticordia huegelii var. tridens (P3) Vli Dem Desmocladus microcarpus (P2) Verticordia lindleyi subsp. lindleyi (P4) Desmocladus nodatus (P3) Verticordia ?lindleyi subsp. lindleyi (P4) V?II Egl?ca Eremophila glabra subsp. ?carnosa (C) Eremophila glabra subsp. chlorella (T) EgSc EpiP Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) (P3) Eucalyptus macrocarpa subsp. elachantha (P4) Emae ▲ FgI Frankenia glomerata (P4) GspC Grevillea cooljarloo (P1) Gsa Grevillea saccata (P4) Guichenotia alba (P3) Gua Hlo Hakea longiflora (P3) Hfo Haloragis foliosa (P3) Hst Hensmania stoniella (P3) Hga Hypocalymma gardneri (P3) Ipap Isopogon panduratus subsp. palustris (P3) Isotropis cuneifolia subsp. glabra (P3) lcug

FIGURE 5.3

LEGEND: Existing Significant Flora Records in the Desktop Study Area

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5.1.5 Significant Vegetation

The interrogation of DBCA's Threatened and Priority Ecological Communities Database (DBCA, 2021a) returned records of the 'Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region' PEC (P3) (equivalent to the 'Banksia Woodlands of the Swan Coastal Plain ecological community' EPBC listed TEC) within the Desktop Study Area and Survey Area. A review of TEC and PEC records on NatureMap (DBCA, 2007-2021) and review of the DBCA TEC and PEC records spatial dataset (DBCA, 2022b) did not identify any additional TECs or PECs within the Desktop Study Area.

The searches of the DCCEEW SPRAT database with regard to MNES listed under the EPBC Act (DAWE, 2021, 2022) returned two Commonwealth-listed TECs that are likely to/may occur within the Desktop Study Area, as listed below. The full results of the DCCEEW database searches are presented in **Appendix D**.

- Banksia Woodlands of the Swan Coastal Plain ecological community (Endangered) 'likely to occur'.
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered) 'may occur'.

A review of the current DBCA TEC and PEC lists (DBCA, 2023d, 2023f) identified one additional significant vegetation community that has the potential to occur within the Desktop Study Area, being the 'Clay pans of the Swan Coastal Plain ecological community' EPBC TEC.

Table 5.4 presents a summary of the three listed significant vegetation communities known from or potentially occurring within the Desktop Study Area. This list has been compiled from the results of searches of DBCA's Threatened and Priority Ecological Communities Database (DBCA, 2021a, 2022b), DCCEEW's SPRAT Database (DAWE, 2021, 2022), review of DBCA TEC and PEC lists (DBCA, 2023d, 2023f), and the results of previous surveys as summarised in **Section 5.1.2**. Communities that have been previously recorded in the Survey Area are shaded blue in **Table 5.4**. Note that some EPBC-listed TECs have an equivalent State PEC listing status; these EPBC TECs/State PECs can also provide an umbrella for a variety of individual State-listed TECs. The relationships between these have been simplified as far as possible in **Table 5.4**.

Indicative locations of the 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC (P3), the only State-listed significant vegetation community with records in the Desktop Study Area, are presented in **Figure 5.4**; these consist of DBCA-applied buffers of 200 m surrounding known locations (as per the metadata from the database interrogation (DBCA, 2021a)). The DBCA Threatened and Priority Ecological Communities Database has mapped the 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC (P3) over the majority of the Survey Area and Desktop Study Area (**Figure 5.4**). According to the DBCA metadata (DBCA, 2021a), the mapping for the Banksia woodlands PEC is based on the Commonwealth's 'likely to occur' areas, and represents the broad-scale vegetation map units most likely to contain this community. According to Woodman Environmental (2014b), this TEC/PEC is considered to be represented by Cooljarloo West VTs 17 and 18, which were mapped at a scale of 1:10,000 across 47.6 % and 18.4 % of the Cooljarloo West Study Area, respectively. Therefore, DBCA's broad-scale mapping combined with the DBCA-applied 200 m buffer has incorporated vegetation in this area that is not considered to represent this TEC/PEC at a local scale.



Table 5.4 Listed Significant Vegetation Known from or Potentially Occurring Within the Desktop Study Area

EPBC TEC	State TEC/PEC	Source*	Comment				
Banksia woodlands of the Swan Coastal Plain ecological community (EN)	Banksia woodlands of the Swan Coastal Plain (P3)	360 DBCA Database DBCA TEC/PEC lists DCCEEW~ Strategen Umwelt WEC	Banksia dominated woodlands of the Swan Coastal Plain IBRA region PEC (P3) has DBCA records in the Survey Area and Desktop Study Area (DBCA, 2021a, 2022b). Note that there are a number of State-listed TECs and PECs that are components of this EPBC-TEC. The majority of these TECs/PECs are considered analogous to SCP FCTs defined by Gibson et al. (1994) on the southern SCP. The area sampled by Gibson et al. extends from Seabird to the foothills of the Whicher Range, and therefore the Survey Area occurs outside this area; consequently, these significant vegetation communities are not considered to occur in the Survey Area.				
Clay pans of the Swan Coastal Plain (CR)	Claypans with mid dense shrublands of Melaleuca lateritia over herbs (P1)	DBCA TEC/PEC lists	The main distribution of this ecological community occurs in the central and southern SCP and Jarrah Forest IBRA Bioregions (TSSC, 2012). Clay pans have been recorded within the Desktop Study Area by previous surveys (specifically, Cooljarloo West VTs 4, 9a and 16). The Survey Area intersects VT 9a only. Note that there are four State-listed TECs that also form components of this EPBC-listed TEC; these TECs are considered analogous to SCP FCTs defined by Gibson et al. (1994) on the southern SCP. The area sampled by Gibson et al. extends from Seabird to the foothills of the Whicher Range, and therefore the Survey Area occurs outside this area; consequently, these significant vegetation communities are not considered to occur in the Survey Area.				
Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community (CR)	Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain) (P3)	DCCEEW^	This TEC/PEC is strongly associated with calcareous soils of the western part of the SCP, including those very close to the coast (DoEE, 2019); it is mostly confined to Quindalup Dunes and Spearwood Dunes from Jurien Bay to the Sabina River, with outliers along some rivers (DBCA, 2023d). Eucalyptus gomphocephala and calcareous soils have both been recorded within the Desktop Study Area (Woodman Environmental, 2014b). Note that this community can intergrade with the 'Banksia woodlands of the Swan Coastal Plain ecological community' TEC, and Eucalyptus gomphocephala can occasionally occur as a separate stratum above a woodland dominated by Banksia spp., in which case the patches are more likely to meet the diagnostic characteristics of the 'Banksia woodlands of the Swan Coastal Plain ecological community' TEC (DoEE, 2019).				

CR = Critically Endangered; EN = Endangered.

360: 360 Environmental (2017a, 2017b)

DCCEEW: Interrogation of DCCEEW SPRAT Database (DAWE, 2021, 2022)

DBCA Database: DBCA (2021a, 2022b)

DBCA TEC/PEC lists: DBCA (DBCA, 2023d, 2023f)

Strategen: Strategen (2020) Umwelt: Umwelt (2022b, 2023)

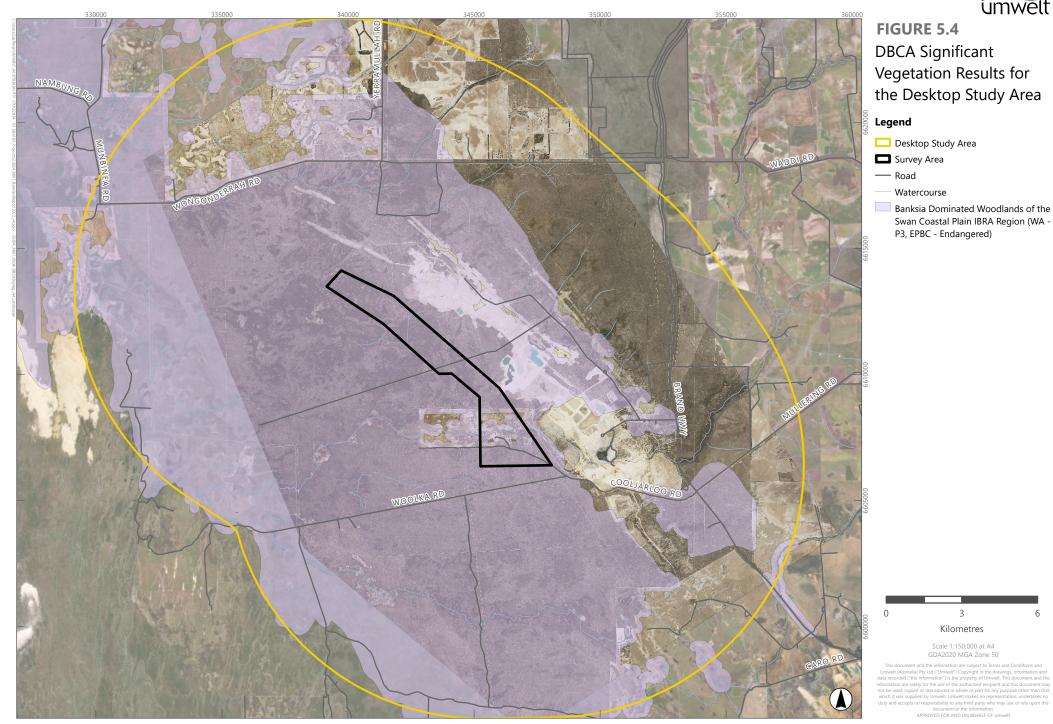
WEC: Woodman Environmental (2017b, 2018b, 2019, 2021).

^{*} Sources are:

[~] Community likely to occur within area (DAWE, 2021, 2022).

[^] Community may occur within area (DAWE, 2021, 2022).





3 Kilometres Scale 1:150,000 at A4 GDA2020 MGA Zone 50



5.1.6 Groundwater and Surface Water Values

5.1.6.1 Groundwater

Phreatophytes are usually deep-rooted perennial taxa that rely on groundwater sources for water uptake. These taxa are often (but not always) found within the riparian zones of permanent and ephemeral rivers, creeks and wetlands where water tables are often very close to the ground surface. Phreatophytes are divided into two main groups:

- **Obligate:** taxa are completely reliant on access to groundwater to survive. This reliance can be continual, seasonal or episodic and is often highly sensitive to alterations in groundwater regimes. Obligate phreatophytes occur in areas where the land surface is close to the groundwater table and directly access groundwater all year round. They can be either supralittoral (generally shallow rooted as groundwater is at a shallow depth under average conditions, for example *Banksia littoralis*), or phreatic (at higher elevations where groundwater is at a greater depth and deeper root systems are required to draw water from the capillary fringe, for example *Banksia ilicifolia*) (Sommer & Froend, 2010). Other taxa in the Northern Sandplains that are obligate phreatophytes include *Melaleuca rhaphiophylla* and occasionally *Melaleuca preissiana*.
- Facultative: taxa that rely on groundwater only during extended periods of drought and are generally deep-rooted species occurring on floodplains and higher in the landscape away from very shallow groundwater aquifers. These species tend to be less sensitive to changes in groundwater regimes, however, may suffer stress during prolonged periods of drought. Such taxa can include those with shallow root systems that can survive periods of dryness, as well as periods of inundation and waterlogged soils (for example, Eucalyptus rudis), or can survive on soil moisture when available in winter and spring and utilise groundwater only during drier periods or higher elevations (phreatic facultative phreatophytes). Other taxa that are representative of facultative phreatophytes in the Northern Sandplains include Banksia attenuata and Banksia menziesii (see below; dependence on groundwater depends on the local situation), Regelia ciliata, Hypocalymma balbakiae, etc.

Depth-to-groundwater can be used as a potential indicator of groundwater dependence by vegetation. Studies on the Northern Sandplains have shown that there is reduced reliance on groundwater by vegetation where depth to groundwater exceeds 10 m (Eamus et al. (2004) in Froend & Loomes (2004); Froend et al. (2011)). Research on *Banksia* species on the Gnangara Mound groundwater system north of Perth and elsewhere in the South-west of Western Australia (Froend & Loomes, 2004, 2006) proposed three main categories of phreatophytic (groundwater dependent) vegetation: 0–3 m, 3–6 m and 6–10 m depth to groundwater, all of which are assumed to utilise groundwater to some extent. The highest groundwater usage is in the 0–3 m and 3–6 m categories. Studies have shown that *Banksia* tree species (including *Banksia attenuata* and *Banksia menziesii*) have the capacity to access groundwater via their deep root systems and in some cases can be dependent on groundwater to some extent (Groom et al., 2000). *Banksia attenuata* and *Banksia menziesii* are known to be groundwater dependent at groundwater depths of 6–7 m (Dodd & Bell, 1993), and these taxa are unlikely to access groundwater at depths of more than 10 m.

The search of the DCCEEW SPRAT Database with regard to MNES listed under the EPBC Act identified one Nationally Important Wetland, being the Lancelin Defence Training Area (DAWE, 2021, 2022) (**Appendix D**). While according to DCCEEW this wetland system occurs in the buffer area only (i.e. not within the Survey



Area), the Directory of Important Wetlands DBCA dataset (DBCA-045) indicates that part of the system is present within the Survey Area (DBCA, 2018).

The Lancelin Defence Training Area consists of 25,000 ha, including wetland areas of approximately 2,000 ha, including large areas of lakes and seasonally inundated basins lying on Bassendean Dunes. The southwest corner and eastern portion of the site contains a regionally significant wetland area recognised for its high conservation value. Due to its proximity to surrounding nature reserves and national parks and the large area of freshwater wetlands on the site, it is likely to support a relatively high diversity of wetland biota. The vegetation of the swamps is variable and may be low or tall heath, sometimes with occasional *Melaleuca rhaphiophylla, Eucalyptus rudis,* or *Xanthorrhoea preissii*. A typical heath community is 1-1.5 m high and consists of *Banksia sphaerocarpa, Hakea varia, Hypocalymma balbakiae, Regelia ciliata, Daviesia divaricata* and *Acacia saligna*. There are also many sedges and reeds (DAWE, 2019).

The BoM GDE Atlas (BoM, 2023b) is a national dataset of Australian GDEs to inform groundwater planning and management. The Atlas was interrogated using the Desktop Study Area boundary to obtain locations and information about two types of GDEs:

- Aquatic GDEs: ecosystems that rely on the surface expression of groundwater this includes surface water ecosystems that may have a groundwater component, such as rivers, wetlands and springs. Note that marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.
- **Terrestrial GDEs:** ecosystems that rely on the subsurface presence of groundwater this includes all vegetation ecosystems.

According to the BoM GDE Atlas (BoM, 2023b), virtually the entire Desktop Study Area, with the exception of the current Cooljarloo mine footprint, has been mapped as 'high' or 'moderate' potential terrestrial GDEs as per the national assessment. These areas are mapped as *Banksia attenuata* and *Banksia menziesii* low woodland; mosaic of Hakea scrub heath with Banksia heath; mosaic of *Acacia rostellifera* and *Acacia cyclops* shrubland with *Melaleuca cardiophylla* shrubland; and *Eucalyptus loxophleba* and *Eucalyptus wandoo* medium woodland. Several 'high' and 'moderate', as well as 'unclassified' potential aquatic GDEs occur within the Desktop Study Area, and 'high' potential within the Survey Area (BoM, 2023b), including the wetlands associated with the Lancelin Defence Training Area. Note that as per the metadata for the BoM GDE Atlas, the national assessment data is taken from a 'national-scale analysis based on a set of rules that describe potential for groundwater/ecosystem interaction and available GIS data'. Known GDEs and their locations were extrapolated to regional scales using a process that relied on the integration of expert opinion, remote sensing data obtained between 2000 and 2010, and GIS analysis (Doody et al., 2017). Therefore, the national assessment data provides only an indication of potential GDEs in an area, and site groundwater data is required to confirm the presence of GDEs.

5.1.6.2 Surface Water

According to the Landgate water features spatial dataset (Landgate, 2022), the Survey Area intersects three natural, non-perennial minor watercourses, including Mullering Brook.

The geomorphic wetlands in the Cervantes South area have been mapped by V & C Semeniuk Research Group in 2006. This dataset was updated by DBCA (then Department of Environment and Conservation) and Department of Water and Environmental Regulation (then Department of Water) in 2010 (DEC, 2011)



and the spatial dataset made available in 2017 (DBCA, 2017b). Wetlands are classified according to their host landform and hydroperiod. Evaluation of conservation significance is not included in this dataset.

The wetlands mapped within by the Desktop Study Area by the DBCA (2017b) geomorphic wetlands dataset is identical to those mapped by the BoM (2023b) aquatic GDE dataset. Within the Survey Area, there are occurrences of damplands (seasonally waterlogged basins), palusplains (seasonally waterlogged flats) and a floodplain (seasonally inundated flats) (DBCA, 2017a).

5.2 Field Survey Results

5.2.1 Vascular Flora Census

A total of 348 discrete vascular flora taxa were recorded in the Survey Area by the 2022 survey. Following review of the Cooljarloo West sample sites in the Survey Area, which included review and updating (where required) of quadrat and relevé data from the current survey in the field, removal of taxa that were not identified further than family or genus level and could not be resolved in the field in 2022 (e.g. *Vulpia sp.), and alignment of taxa where the Cooljarloo West survey did not identify material further than species level (e.g. Daviesia decurrens and Daviesia decurrens subsp. decurrens), it is considered that 58 discrete vascular flora taxa recorded by the Cooljarloo West survey in the Survey Area are additional to those recorded by the 2022 survey.

It is therefore considered that 406 discrete vascular flora taxa have been recorded in the Survey Area by the Cooljarloo West and 2022 surveys, representing 65 families and 200 genera. The most well-represented families were Myrtaceae (92 taxa), Proteaceae (67 taxa), Asteraceae (54 taxa) and Fabaceae (51 taxa). A total of 90 taxa are considered to be annual/ephemeral (22.2 % of taxa), and 26 taxa are introduced (6.4 % of taxa) (see **Section 5.2.4**).

Within quadrats established in the Survey Area by the 2022 or Cooljarloo West surveys, average native taxon richness per quadrat was 30 (± 13), with the greatest number of taxa recorded in a single quadrat being 65 (OMP07), and the lowest number being 5 (LFGS08).

A full list of flora taxa recorded by the 2022 survey and Cooljarloo West survey in the Survey Area is presented in **Appendix F**. Raw quadrat and relevé data from sites in the Survey Area are presented in **Appendix G** (including those previously established for the Cooljarloo West Survey).

Note that several collections could not be identified to species level due to poor material. Some are known to be distinct taxa relative to other taxa recorded by the survey, and therefore have been included in the totals presented above and in **Appendix F** (e.g. *Mirbelia ?spinosa*). Other collections may represent distinct taxa relative to other taxa recorded by the survey; however, it is more likely that they represent taxa already recorded elsewhere, with the quality of the material such that this distinction cannot be made (e.g. Asteraceae sp.). Such collections are not included in the totals above or presented in **Appendix F**. None of these collections are considered to represent significant flora taxa.



5.2.2 Significant Flora Taxa

5.2.2.1 Overview of Significant Flora Taxa

Table 5.5 presents a summary of data relating to significant flora taxa recorded by the 2022 survey in the Survey Area at quadrats/relevés or opportunistically. A total of 14 significant flora taxa were recorded, including one Threatened taxon listed under the BC and EPBC Acts (*Anigozanthos viridis* subsp. *terraspectans*). Two significant flora taxa were recorded in the Survey Area for the first time by the 2022 survey, being *Hypocalymma quadrangulare* (P3) and *Poranthera asybosca* (P1); however, these taxa have previous known records in close proximity to the Survey Area (**Section 5.1.4**).

Note that for the purposes of **Table 5.5**, the number of individuals at locations where plant counts were not recorded (e.g. within quadrats) has been attributed an abundance of 1.

Table 5.5 also includes a summary of the VTs within which each significant flora taxon was recorded (VT descriptions provided in **Section 5.2.5**). Preferred habitat for each taxon has been determined based on proportional location representation and landforms/soils and is indicated in **Table 5.5** with '^'. However, it is worthy of note that some taxa recorded by the 2022 survey were recorded from few locations, and therefore there may not be sufficient data to confidently assign preferred habitat for these taxa. Following completion of Targeted survey in 2023, and compilation of complete data of the distribution of significant flora taxa in the Survey Area (including data from relevant previous surveys), preferred habitat information can be confirmed.

An overview of locations of significant flora taxa recorded in the Survey Area by the 2022 survey are presented in **Figure 5.5**, with detailed locations provided with VT mapping in **Appendix K**. A detailed description and summary of information for each taxon recorded in the Survey Area is provided in **Section 5.2.2.2** to **Section 5.2.2.14**, and location coordinates are presented in **Appendix H**.

Note that as discussed in **Section 1.4**, the 2022 survey did not include Targeted survey for significant flora taxa. Therefore, it is likely that further locations and individuals of the taxa presented in **Table 5.5** occur in the Survey Area. Furthermore, as discussed in **Section 5.1.4**, a large number of significant flora taxa not recorded by the 2022 survey have been previously recorded in the Survey Area by previous assessments. Targeted flora survey would be required to understand the distributions of significant flora taxa in the Survey Area.



Table 5.5 Summary of Significant Flora Taxa Recorded in the Survey Area by the 2022 Survey

Taxon	Status (WA)	Status (EPBC)	Number of Locations	Number of Individuals	VTs*
Anigozanthos viridis subsp. terraspectans	Т	VU	6	6	W-A^, W-C
Babingtonia urbana	Р3		7	7	W-A^, W-C
Chordifex reseminans	P2		8	12	W-C^
Conospermum scaposum	Р3		1	1	W-C^
Desmocladus nodatus	Р3		3	3	W-C^
Grevillea cooljarloo	P1		1	1	W-D^
Hypocalymma quadrangulare	P3		8	8	D-A^, D-B^, W-C
Isopogon panduratus subsp. palustris	Р3		22	64	W-B^, W-C^, W-E
Lepyrodia curvescens	P2		1	1	W-C^
Persoonia rudis	Р3		1	3	W-C^
Poranthera asybosca	P1		7	26	D-A^, D-B^, W-C
Schoenus griffinianus	P4		1	7	W-C^
Stylidium hymenocraspedum	Р3		1	1	D-B^
Verticordia lindleyi subsp. lindleyi	P4		7	12	W-C^

^{*} Refer to **Section 5.2.5** for VT descriptions.

[^] Designates preferred habitat, based on proportional location representation and landforms/soils.



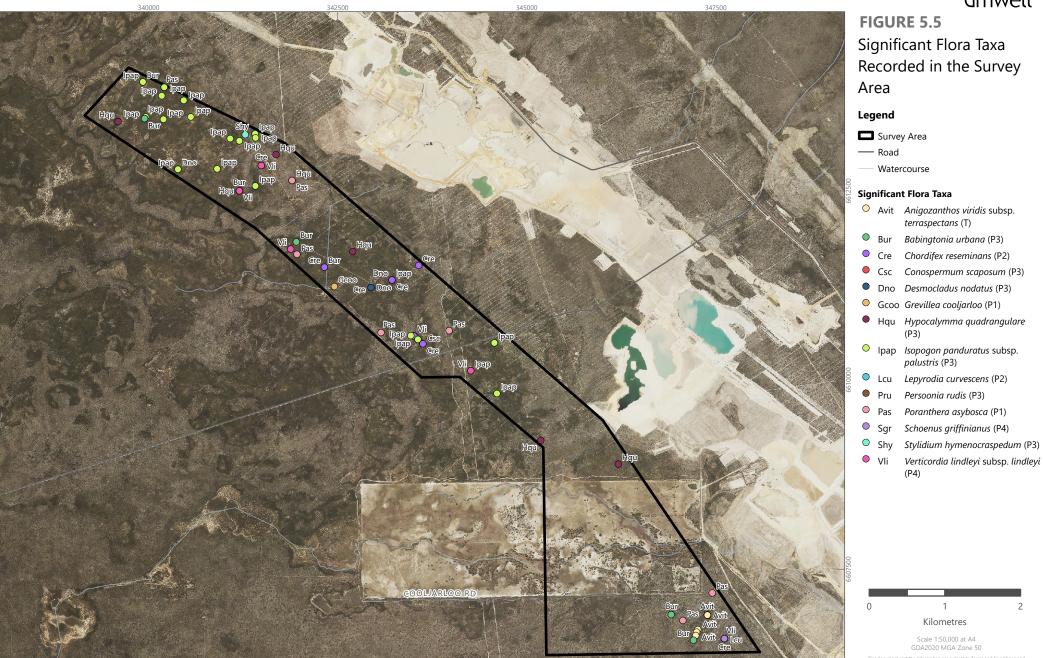


Image Source: Tronox, ESRI Basemap (2021) | Data Source: Landgate (2023), Umwelt (2023), Tronox (2022)

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5.2.2.2 Anigozanthos viridis subsp. terraspectans (T)

Anigozanthos viridis subsp. terraspectans (T) is a rhizomatous, perennial herb with green flowers, growing to 0.2 m in height (**Photo 5.1**). The taxon occurs on grey sand and clay loam in winter-wet depressions and wetlands (WA Herbarium, 1998-). This taxon is listed under the BC Act and EPBC Act as Threatened (Vulnerable) (DBCA, 2023e; DCCEEW, 2023c).

Anigozanthos viridis subsp. terraspectans (T) is endemic to WA (ALA, 2023), occurring over a relatively restricted range of approximately 75 km from Cooljarloo in the north to Beermullah near Moore River National Park in the south. There are 17 records of this taxon in the WA Herbarium Specimen Database¹, potentially representing approximately 15 regional populations, two of which occur within DBCA conservation estate (Namming Nature Reserve and unnamed reserve R 40916 approximately 5 km south of the Survey Area) (WA Herbarium, 1998-). The Survey Area is located within the northern extent of the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Six individuals of *Anigozanthos viridis* subsp. *terraspectans* (T) were recorded by the 2022 survey at six point locations in a single large wetland in the southeastern corner of the Survey Area (**Figure 5.5**). The locations of this taxon occur within VTs W-A and W-C (but near the boundary with W-A), with VT W-A (i.e. clay pans) representing the preferred habitat for this taxon.



Photo 5.1 Anigozanthos viridis subsp. terraspectans (T) (photo: Umwelt)

¹ Number of unique locations as per WA Herbarium Specimen Database accessed via Florabase (WA Herbarium, 1998-). Note that the number of unique locations is different to the total number of taxon specimens held at the WA Herbarium, which is often higher due to multiple specimens being lodged from a given location. However, it is worth noting that the coordinates entered into and stored in the WA Herbarium database do not always fully correspond with collector's original location description, or the location was not given in sufficient detail, and as such often represents an approximation rather than an exact location.



5.2.2.3 Babingtonia urbana (P3)

Babingtonia urbana (P3) is a shrub growing to 0.7 m high with erect slender stems and antrorse to widely spreading leaves and pink flowers (**Photo 5.2**). The taxon occurs in winter-wet depressions, flats and swamps with brown or white clay loam (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Babingtonia urbana (P3) is endemic to WA (ALA, 2023), occurring over a range of approximately 200 km from Cooljarloo in the north to west of Mundijong in the south; however, records are from three disjunct areas, being the Perth area, Cooljarloo area and near Moora. There are 26 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 13 regional populations, none of which occur within DBCA conservation estate (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Babingtonia urbana (P3) was recorded by the 2022 survey at seven locations across the Survey Area (**Figure 5.5**). The locations of this taxon occur within VTs W-A and W-C, with VT W-A representing the preferred habitat for this taxon.



Photo 5.2 Babingtonia urbana (P3) (photos: Umwelt)



5.2.2.4 Chordifex reseminans (P2)

Chordifex reseminans (P2) is an erect, tufted perennial rush growing to 0.9 m high (**Photo 5.3**), occurring on flats and winter-wet depressions with white-grey sand over laterite (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P2 by DBCA (2023e).

Chordifex reseminans (P2) is endemic to WA (ALA, 2023), occurring over a range of approximately 130 km from Eneabba in the north to Regans Ford in the south. There are 28 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 21 regional populations, five of which occur within DBCA conservation estate (Badgingarra National Park and Namming Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

A total of 12 individuals of *Chordifex reseminans* (P2) were recorded by the 2022 survey at eight point locations across the Survey Area (**Figure 5.5**). The locations of this taxon occur within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.3 Chordifex reseminans (P2) (photo: Umwelt)



5.2.2.5 Conospermum scaposum (P3)

Conospermum scaposum (P3) is an erect shrub with purple flowers, growing to 0.45 m high (**Photo 5.4**). The taxon occurs on winter-wet flats and depressions with white, brown or grey sand (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Conospermum scaposum (P3) is endemic to WA (ALA, 2023), occurring over a range of approximately 400 km from Eneabba in the north to Narrogin in the south. There are 46 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 33 regional populations, six of which occur within DBCA conservation estate (Wandoo National Park and Lake Wannamal Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

One individual of *Conospermum scaposum* (P3) was recorded by the 2022 survey at a single point location in the centre of the Survey Area (**Figure 5.5**). This location occurs within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.4 Conospermum scaposum (P3) (photos: Umwelt)



5.2.2.6 Desmocladus nodatus (P3)

Desmocladus nodatus (P3) is an erect, tufted perennial rush growing to 0.2 m high (**Photo 5.5**), occurring on winter-wet flats, wetlands and edges of wetlands with white, grey or brown sandy clay (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Desmocladus nodatus (P3) is endemic to WA (ALA, 2023), occurring over a restricted range of approximately 42 km from Cooljarloo to Mimegarra. There are 21 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 18 regional populations, one of which occurs within DBCA conservation estate (Wongonderrah Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Desmocladus nodatus (P3) was recorded by the 2022 survey at three point locations in the northwestern part of the Survey Area (**Figure 5.5**). The locations of this taxon occur within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.5 Desmocladus nodatus (P3) (photo: Umwelt)



5.2.2.7 *Grevillea cooljarloo* (P1)

Grevillea cooljarloo (P1) (previously Grevillea sp. Cooljarloo (B.J. Keighery 28 B)) is a lignotuberous, spreading, multi-stemmed shrub with red flowers, growing to 0.6 m high (**Photo 5.6**). The taxon occurs on low flats and winter-wet areas with grey or white sand or sandy clay (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P1 by DBCA (2023e).

Grevillea cooljarloo (P1) is endemic to WA (ALA, 2023), occurring over a relatively restricted range of approximately 80 km from Warradarge to Cooljarloo. There are 16 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 12 regional populations, one of which occurs within DBCA conservation estate (Nambung National Park) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (as *Grevillea* sp. Cooljarloo (B.J. Keighery 28 B)) (Section 5.1.4).

Grevillea cooljarloo (P1) was recorded by the 2022 survey at one location in the centre of the Survey Area (**Figure 5.5**). This location occurs within VT W-D, which represents the preferred habitat for this taxon.



Photo 5.6 Grevillea cooljarloo (P1) (photo: Umwelt)



5.2.2.8 Hypocalymma quadrangulare (P3)

Hypocalymma quadrangulare (P3) (previously Hypocalymma sp. Nambung (R. Spjut & R. Smith s.n. 22/09/1992)) is an erect, multi-stemmed shrub with square shaped stems and yellow flowers, growing to 0.45 m high (**Photo 5.7**). The taxon occurs in Banksia woodland or in shrublands on lower slopes with grey or yellow sand (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Hypocalymma quadrangulare (P3) is endemic to WA (ALA, 2023), occurring over a range of approximately 100 km from Badgingarra in the north to Yeal in the south. There are seven records of this taxon in the WA Herbarium Specimen Database (excluding a record from a plant cultivated at the WA Herbarium), potentially representing approximately six regional populations, two of which occur within DBCA conservation estate (Moore River National Park and State Forest 65) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and while it has been recorded in the Cooljarloo West Study Area (Section 5.1.4), the records from the 2022 survey represent the first records of the taxon in the Survey Area.

Hypocalymma quadrangulare (P3) was recorded by the 2022 survey at eight point locations in the northern and central parts of the Survey Area (**Figure 5.5**). The locations of this taxon occur within VTs D-A, D-B and W-C (but generally near the boundary with D-A or D-B), with VTs D-A and D-B representing the preferred habitat for this taxon.



Photo 5.7 *Hypocalymma quadrangulare* (P3) (photo: Umwelt)



5.2.2.9 Isopogon panduratus subsp. palustris (P3)

Isopogon panduratus subsp. palustris (P3) is a spreading shrub growing to 2 m high (**Photo 5.8**), occurring on low flats and winter-wet areas with sand or sandy clay (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Isopogon panduratus subsp. palustris (P3) is endemic to WA (ALA, 2023), occurring over a restricted range of approximately 33 km from Nambung to Cooljarloo. There are 23 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 20 regional populations, one of which occurs within DBCA conservation estate (Wongonderrah Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area.

A total of 64 individuals of *Isopogon panduratus* subsp. *palustris* (P3) were recorded by the 2022 survey at twenty-two point locations in the northern and central parts of the Survey Area (**Figure 5.5**). The locations of this taxon occur within VTs W-B, W-C and W-E, with VTs W-B and W-C representing the preferred habitat for this taxon.



Photo 5.8 Isopogon panduratus subsp. palustris (P3) (photo: Umwelt)



5.2.2.10 Lepyrodia curvescens (P2)

Lepyrodia curvescens (P2) is a dioecious, tufted rhizomatous herb growing to 0.4 m high (**Photo 5.9**), occurring on plains, winter wet flats, depressions and edges of wetlands with grey sandy loam (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P2 by DBCA (2023e).

Lepyrodia curvescens (P2) is endemic to WA (ALA, 2023), occurring over a range of approximately 307 km from Warradarge in the north to Meelon (southeast of Pinjarra). There are 21 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 13 regional populations, four of which occur within DBCA conservation estate (Lesueur National Park, South Eneabba Nature Reserve, Burnside Nature Reserve and Brixton Street Wetlands) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area.

Lepyrodia curvescens (P2) was recorded by the 2022 survey at one location in a wetland in the southeastern corner of the Survey Area (Figure 5.5). This location occurs within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.9 Lepyrodia curvescens (P2) (scanned Umwelt specimen)



5.2.2.11 Persoonia rudis (P3)

Persoonia rudis (P3) is an erect, often spreading shrub with yellow flowers, growing to 1 m high (Photo 5.10). The taxon occurs on sandplains and flats with white, grey or yellow sand, often over laterite (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Persoonia rudis (P3) is endemic to WA (ALA, 2023), occurring over a range of approximately 260 km from Mount Adams in the north to Bullsbrook in the south. There are 42 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 35 regional populations, 12 of which occur within DBCA conservation estate (Lesueur National Park, South Eneabba Nature Reserve, Boonanarring Nature Reserve and Bullsbrook Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Three individuals of *Persoonia rudis* (P3) were recorded by the 2022 survey at one location in a wetland in the southeastern corner of the Survey Area (**Figure 5.5**). This location occurs within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.10 Persoonia rudis (P3) (photos: Umwelt)



5.2.2.12 Poranthera asybosca (P1)

Poranthera asybosca (P1) is a small annual with reddish green stems and pink flowers growing to 20 to 45 mm tall (**Photo 5.11**), occurring in open kwongan shrubland on white sand over laterite (Barrett & Barrett, 2015; WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P1 by DBCA (2023e).

Poranthera asybosca (P1) is endemic to WA (ALA, 2023), and according to the WA Herbarium Specimen Database (1998-), is only known from two locations, with the first being east of Beekeepers Nature Reserve between Arrowsmith and Eneabba, and the second being approximately 100 km to the south of that location in the Wongonderrah Nature Reserve. However, Umwelt have made collections of this taxon in Arrowsmith near Yardanogo Nature Reserve, and south to Cooljarloo, extending the known range of the taxon to approximately 150 km. Representative specimens and TPFRFs have been supplied to the WA Herbarium and DBCA, respectively; however, these records have not yet been uploaded to Florabase.

With the two records in the WA Herbarium Specimen Database and all records held in Umwelt's database, *Poranthera asybosca* (P1) is known from 110 locations, potentially representing approximately 16 regional populations, three of which occur within DBCA conservation estate (Lesueur National Park, and Wongonderrah and South Eneabba Nature Reserves). The Survey Area is located within the southern extent of the known range of this taxon, and while it has been recorded in the Cooljarloo West Study Area by drill line surveys for Tronox (Section 5.1.4), the records from the 2022 survey represent the first records of the taxon in the Survey Area.

Approximately 26 individuals of *Poranthera asybosca* (P1) were recorded by the 2022 survey at seven point locations across the Survey Area (**Figure 5.5**); however, given this is a small, annual taxon, this abundance information is considered to be indicative only. The locations of this taxon occur within VTs D-A, D-B and W-C (however near the boundary with D-A or D-B), with VTs D-A and D-B representing the preferred habitat for this taxon.



Photo 5.11 Poranthera asybosca (P1) (photo: Umwelt)



5.2.2.13 Schoenus griffinianus (P4)

Schoenus griffinianus (P4) is a small, tufted perennial sedge growing to 0.1 m high (**Photo 5.12**). The taxon occurs on sandplains and flats with white-grey sand (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P4 by DBCA (2023e).

Schoenus griffinianus (P4) is endemic to WA (ALA, 2023), occurring over a range of approximately 560 km from Geraldton to Lake Grace. There are 39 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 37 regional populations, 10 of which occur within DBCA conservation estate (Moore River National Park, and Fynes, South Eneabba, Lake Logue and Tarin Rock Nature Reserves) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Seven individuals of *Schoenus griffinianus* (P4) were recorded by the 2022 survey at one location in a wetland in the southeastern corner of the Survey Area (**Figure 5.5**). This location occurs within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.12 Schoenus griffinianus (P4) (photo: Umwelt)



5.2.2.14 Stylidium hymenocraspedum (P3)

Stylidium hymenocraspedum (P3) is a rosetted perennial herb growing to 0.7 m high, with spathulate leaves with a hyaline margin, and yellow flowers (**Photo 5.13**). The taxon grows on sand over laterite, in heath and in Banksia and *Eucalyptus todtiana* low open woodland (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P3 by DBCA (2023e).

Stylidium hymenocraspedum (P3) is endemic to WA (ALA, 2023), occurring over a restricted range of approximately 45 km from just north of Badgingarra National Park to northwest of Eneminga Nature Reserve. There are 33 records of this taxon in the WA Herbarium Specimen Database, potentially representing approximately 28 regional populations, 11 of which occur within DBCA conservation estate (Badgingarra National Park and Wongonderrah Nature Reserve) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

Stylidium hymenocraspedum (P3) was recorded by the 2022 survey at one location in the northwestern part of the Survey Area (**Figure 5.5**). This location occurs within VT D-B, which represents the preferred habitat for this taxon.



Photo 5.13 Stylidium hymenocraspedum (P3) (photos: Umwelt)



5.2.2.15 Verticordia lindleyi subsp. lindleyi (P4)

Verticordia lindleyi subsp. *lindleyi* (P4) is an erect shrub with pink/purple flowers, growing to 0.75 m high (**Photo 5.14**). The taxon occurs on plains, winter-wet depressions and flats with white, brown or grey sand (WA Herbarium, 1998-). This taxon is not listed under the EPBC Act or BC Act, but is classified as P4 by DBCA (2023e).

Verticordia lindleyi subsp. lindleyi (P4) is endemic to WA (ALA, 2023), occurring over a range of approximately 200 km from Dandaragan in the north to Serpentine in the south. There are 82 records of this taxon in the WA Herbarium Specimen Database (excluding an erroneous disjunct record from the Capel area), potentially representing approximately 63 regional populations, seven of which occur within DBCA conservation estate (Whiteman Park, Moore River National Park, and Boonanarring, Namming and Fynes Nature Reserves) (WA Herbarium, 1998-). The Survey Area is located within the known range of this taxon, and it has been previously recorded in the Survey Area (Section 5.1.4).

A total of 12 individuals of *Verticordia lindleyi* subsp. *lindleyi* (P4) were recorded by the 2022 survey at seven point locations across the Survey Area (**Figure 5.5**). The locations of this taxon occur within VT W-C, which represents the preferred habitat for this taxon.



Photo 5.14 Verticordia lindleyi subsp. lindleyi (P4) (photo: Umwelt)



5.2.2.16 Likelihood of Occurrence of Further Significant Flora

As discussed in **Section 5.1.4**, a total of 105 significant flora taxa were identified as occurring (or potentially occurring) within the Desktop Study Area prior to survey, comprising 18 taxa listed as Threatened under the EPBC and/or BC Acts, 85 DBCA-classified Priority flora taxa, and two potentially undescribed taxa. Of the 105 taxa identified by the desktop assessment, 14 were recorded within the Survey Area by the 2022 survey at quadrats/relevés or opportunistically (**Section 5.2.2**), and a further 11 have been recorded in the Survey Area by previous assessments (**Section 5.1.2**).

Appendix I presents an assessment of the likelihood of the remaining 80 taxa occurring in the Survey Area. This assessment considered whether a taxon was identifiable at the time of survey, the known range of the taxon and proximity of known records to the Survey Area when determining the potential for a taxon to occur in the Survey Area.

To assist with determining whether suitable habitat may be present in the Survey Area, **Appendix I** presents information on 2022 and Cooljarloo West VTs within which known locations of significant flora taxa have been recorded (significant flora locations data from DBCA (2021b) and the Tronox-Iluka significant flora database (Iluka, 2021)). Note that many significant flora records are located within areas that have not been mapped; therefore, this data is not intended to be definitive, but rather is intended to assist where habitat information from specimens lodged at the WA Herbarium (1998-) is insufficient.

It is considered that of the 80 taxa that were returned by the desktop assessment but that have not been recorded in the Survey Area (by the 2022 survey or other previous assessments), only one taxon, *Myriophyllum muelleri* (P1), would theoretically not be identifiable at the time of the 2022 survey; this taxon is an annual species that is known from only two records, one from the beginning and the other from the end of November (WA Herbarium, 1998-). The 2022 survey was undertaken in October (one site visit at the beginning of October, and the other from mid to late October). It is possible that the second site visit may have captured the emergent period of this taxon, but with so little data available for the taxon, this cannot be determined conclusively. Nevertheless, *Myriophyllum muelleri* (P1) is considered unlikely to occur in the Survey Area, as habitat is not considered to be present (inundated winter-wet depressions, freshwater lagoons) (**Appendix I**).

The remaining 79 significant flora taxa were considered likely to be identifiable during the 2022 survey, either because the survey period coincides with the taxon's flowering period, or the taxon can be identified reliably when in fruit or sterile. Of these, 16 taxa were considered to possibly still occur in the Survey Area as suitable habitat is potentially present, and the Survey Area is within (or in close proximity to) the taxa's known ranges (**Appendix I**). These 16 taxa are:

- Anigozanthos humilis subsp. chrysanthus (P4)
- Arnocrinum gracillimum (P3)
- Babingtonia delicata (P1)
- Calectasia palustris (P2)
- Comesperma rhadinocarpum (P2)
- Eremophila glabra subsp. chlorella (T)



- Guichenotia alba (P3)
- Isotropis cuneifolia subsp. glabra (P3)
- Levenhookia preissii (P1)
- Paracaleana dixonii (T)
- Platysace ramosissima (P3)
- Poranthera moorokatta (P2)
- Stenanthemum sublineare (P2)
- Stylidium aceratum (P3)
- Thelymitra apiculata (P4)
- Thelymitra pulcherrima (P2).

The other 63 taxa are considered unlikely to potentially still occur in the Survey Area; this is because the Survey Area occurs outside the species' known ranges, and/or potential habitat is not considered to be present (**Appendix I**).

As per Section 5.1.4, historic records of Babingtonia aff. cherticola, Calytrix aff. eneabbensis and Stylidium carnosum subsp. ?Narrow leaves (J.A. Wege 490) are present within the Desktop Study Area. The potential taxonomic and conservation significance of Babingtonia aff. cherticola cannot be resolved until further study is undertaken by Barbara Rye or another Chamelaucieae expert. In the meantime, this entity is still considered to represent a potentially undescribed taxon. However, no taxa resembling this entity were observed in the Survey Area, and the Survey Area occurs west of all recorded locations of this entity as per lodgements at the WA Herbarium. Therefore, this taxon is considered unlikely to be present in the Survey Area. As per Appendix I, Stylidium carnosum subsp. ?Narrow leaves (J.A. Wege 490) is also considered unlikely to be present in the Survey Area, due to lack of suitable habitat being present; this taxon typically occurs in lateritic areas, while the Survey Area has very little laterite influence. Finally, guidance from the WA Herbarium has been sought regarding the entity referred to as Calytrix aff. eneabbensis. Specimens lodged at the herbarium with this identification have been reviewed, and they do not appear to strongly resemble Calytrix eneabbensis; it is possible that they may represent a novel taxon, or variation of another Calytrix taxon. However, no individuals that resemble the entity referred to as Calytrix aff. eneabbensis were recorded by the 2022 survey, nor other previous surveys undertaken in the Osprey area for Tronox. Therefore, it is considered unlikely to occur in the Survey Area.

5.2.3 Distribution Extensions and Distribution Gaps

Table 5.6 presents a list of flora taxa collected in the Survey Area during the 2022 survey, for which the collections represent extensions (greater than approximately 50 km) to the known distribution of such taxa, or otherwise fill gaps within their known distributions, according to Florabase (WA Herbarium, 1998-). **Table 5.6** also indicates whether these taxa were recorded by the Cooljarloo West survey. Where taxa listed in **Table 5.6** have been recorded by the Cooljarloo West survey, this indicates that material was not submitted to the WA Herbarium for lodgement, or the WA Herbarium has not lodged submitted specimens (in accordance with its own requirements).



Collections of six taxa made during the 2022 survey represent range extensions or fill gaps within their known distributions; of these, five were recorded by the Cooljarloo West survey. Specimen material from these taxa will be lodged at the WA Herbarium by Umwelt as per the requirements of EPA Technical Guidance (EPA, 2016b), where such material is of sufficient quality.

Note that although collections of taxa that are 'representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)' can be considered significant taxa as per EPA definitions (2016a, 2016b), none of the taxa listed in **Table 5.6** are considered to be significant taxa in this context, as they are all known from wide distributions.

Table 5.6 Flora Taxa Where Collections Represent Range Extensions or Fill Distribution Gaps

Taxon	Description	Recorded Previously
Acacia cyclops	Fills a distribution gap of approx. 205 km	Υ
Cassytha glabella forma casuarinae	Fills a distribution gap of approx. 115 km	N
Cassytha glabella forma glabella	Fills a distribution gap of approx. 235 km	Y (as Cassytha glabella forma ?glabella)
Conostylis prolifera	Fills a distribution gap of approx. 110 km	Υ
Hakea sulcata	Range extension of approx. 62 km to northwest	Y
Olearia axillaris	Fills a distribution gap of approx. 85 km	Y

5.2.4 Introduced Flora Taxa

The vegetation of the Survey Area was generally in Excellent condition (discussed further in **Section 5.2.9**), with a total of 26 introduced flora taxa recorded at quadrats/relevés or opportunistically by the 2022 survey. All introduced flora taxa were present in low numbers. These taxa are listed in **Table 5.7**, along with ecological impact and invasiveness ratings for each introduced taxon under the *Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife for the Midwest Region* (DBCA, 2014). No Declared Pests listed under the BAM Act or WoNS were recorded in the Survey Area. There were no introduced flora taxa recorded in the Survey Area for the Cooljarloo West survey that are additional to the 26 taxa recorded by the 2022 survey.

Of the 26 introduced flora taxa recorded in the Survey Area, 11 have not been rated for ecological impact by DBCA (2014) (**Table 5.7**). As noted above, none of these taxa are listed as Declared Pests or WoNS, and according to Hussey et al. (2007), while many of these weeds are common and widespread in WA, they are not noted as being serious environmental weeds.

Seven introduced flora taxa recorded in the Survey Area are rated as having 'High' ecological impact (**Table 5.7**). Taxa with this ecological impact rating are considered significant weeds capable of causing acute disruption of ecological processes, as well as dominating and/or significantly altering the vegetation structure, composition and function of ecosystems (DBCA, 2014). Of note is *Gladiolus caryophyllaceus, which is considered a 'serious invader of relatively undisturbed Banksia woodland' (Brown & Brooks, 2002).

All but three of the introduced flora taxa recorded in the Survey Area by the current survey are rated as having 'Rapid' invasiveness in native vegetation (**Table 5.7**). This describes the rate of spread of a weed in native vegetation, encompassing factors of establishment (including the ability to outcompete and the requirement for disturbance to establish), reproduction factors (including time to seeding and



seed/vegetative production) and long distance dispersal mechanisms (> 100 m) (DBCA, 2014). Taxa with 'Rapid' invasiveness ratings are typically disturbance opportunists and are relatively common around disturbance areas, on road verges, and along drainage lines and other areas of periodic inundation.

Table 5.7 Introduced Flora Taxa Recorded in the Survey Area

Taxon	Common Name	Ecological Impact*	Invasiveness*
Aira caryophyllea subsp. caryophyllea	Silvery Hairgrass	High	Rapid
Aira cupaniana	Hairgrass	High	Rapid
Arctotheca calendula	Capeweed	High	Rapid
Avellinia festucoides	Avellinia	High	Rapid
Briza maxima	Blowfly Grass	Unknown	Rapid
Briza minor	Shivery Grass	Unknown	Rapid
Cicendia filiformis	Cicendia	Low	Slow
Ehrharta calycina	Perennial Veldt Grass	High	Rapid
Ficinia marginata	Coarse Clubrush	Unknown	Rapid
Galium murale	Small Goosegrass	Unknown	Rapid
Gladiolus caryophyllaceus	Gladiolus	High	Rapid
Heliophila pusilla	Heliophila	Unknown	Rapid
Hypochaeris glabra	Flatweed	Low	Rapid
Juncus capitatus	Capitate Rush	Low	Rapid
Lysimachia arvensis	Scarlet Pimpernel	Low	Rapid
Ornithopus compressus	Yellow Serradella	Low	Rapid
Ornithopus sativus	French Serradella	Low	Rapid
Orobanche minor	Lesser Broomrape	Unknown	Rapid
Parentucellia latifolia	Common Bartsia	Medium	Rapid
Pentameris airoides subsp. airoides	False Hairgrass	Unknown	Rapid
Sagina apetala	Annual Pearlwort	Low	Moderate
Sonchus oleraceus	Common Sowthistle	Unknown	Rapid
Trifolium arvense var. arvense	Haresfoot Clover	Unknown	Moderate
Ursinia anthemoides subsp. anthemoides	Ursinia	High	Rapid
Vulpia myuros forma myuros	Rat's Tail Fescue	Unknown	Rapid
Wahlenbergia capensis	Cape Bluebell	Unknown	Rapid

^{*} Source: Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife Midwest Region Species Prioritisation Process (DBCA, 2014).

5.2.5 Vegetation of the Survey Area

PCA of the two quadrat datasets (2022 quadrat data only, and combined 2022 and historical Survey Area quadrat data) determined that eight and five clusters, respectively, may be appropriate to capture the majority of the variation in the datasets; the 'elbow' of the scree plots as presented in **Appendix J** indicates where the eigenvalues level off, and hence the principal components to the left of this point should be retained as significant. Also presented in **Appendix J** are the 2D cluster plots (clusters denoted by different colours and symbology), taxon group matrices (clusters denoted by vertical and horizontal spacings) and clustering dendrograms (clusters denoted by grey hashed boxes); these plots were generated using the



number of clusters indicated by PCA as being appropriate for the two datasets. All plots were initially examined at this level, to determine the plausibility of clusters with regard to taxon groups, as well as field observations.

The process described above identified that the first and last clusters both represented two discrete vegetation types, and should therefore both be split into two separate groups. This was supported by review of the 2D cluster plots and taxon group matrices, with the latter in particular demonstrating relatively clear compositional differences between the groups (**Appendix J**).

In addition, quadrat OLF12 was determined to represent a discrete vegetation community; this quadrat was assigned its own cluster in the analysis 1 dendrogram, and was located far from any cluster ellipses in the 2D cluster plots of both analysis 1 and 2 (**Appendix J**). Although the decision to recognise this quadrat as a discrete VT is somewhat tentative given the limited sample size, this quadrat was located on a rocky, ironstone hill, which is an unusual landform relative to the remainder of the Survey Area. In addition, the taxon composition of quadrat OLF12 indicates that it likely represents vegetation discrete from all other VTs described in the Survey Area. It should be noted that this quadrat was classified in analysis 2 within a group of quadrats that were ultimately determined to represent a different VT; it is considered that this quadrat was misclassified in this analysis, likely due to the limited sampling of the vegetation considered to represent this VT. This VT is apparently restricted within the Survey Area, with aerial photograph interpretation indicating that the occurrence of this vegetation pattern within which quadrat OFL12 is located, is likely the only occurrence in the Survey Area, thus preventing replication of quadrats within the VT.

Review of the analyses outputs of the two quadrat datasets determined that the quadrat groupings were generally very similar in both analyses, with the only notable difference between the dendrograms of analyses one and two being the grouping of quadrats LFGS10 and OLF28. In analysis one (2022 quadrats only), these two quadrats clustered together, split at a cophenetic distance² of approximately 0.68 from quadrats OLF08, OLF15 and OLF31 that were assigned to VT D-A (discussed further below). However, in analysis two (2022 and Cooljarloo West quadrats in the Survey Area), these two quadrats again clustered together, split at a cophenetic distance of approximately 0.71 from a large group of quadrats that were assigned to VT W-C (Appendix J). Quadrat LFGS10 is located within an area previously mapped for the Cooljarloo West assessment as VT 1, while OLF28 is in an area previously mapped as VT 17. Review of aerial photography and quadrat species composition, as well other characteristics including topography, soils, and geographic location, indicates both quadrats likely sample vegetation spatially located within the interface of two vegetation types, and therefore possess taxa common to both. For example, both quadrats contain Banksia menziesii, Eremaea asterocarpa subsp. asterocarpa and Hibbertia hypericoides subsp. hypericoides, which are typically found in dryland vegetation, as well as containing Banksia telmatiaea, which is typically only found in wetland vegetation. Following review of all analyses outputs (including those of analysis three with 2022 quadrat data and the entire Cooljarloo West quadrat dataset; Section 5.2.6), aerial photography, and biotic and abiotic data, it was ultimately decided to retain the grouping of quadrats LFGS10 and OLF28 within the group determined by analysis two as being most appropriate for these quadrats (i.e. VT W-C).

In summary, analysis two was determined to be the most appropriate analysis for the Survey Area quadrat data. There were eight plausible quadrat groups that are considered to represent VTs in the Survey Area; these groups were resolved at differing levels of similarity. As noted above, two clusters were split into two

² Cophenetic distance is a correlation measure of intergroup dissimilarity at which two observations are first combined into a single cluster in the dendrogram. Observations that are not correlated have a distance of 1. Distances close to 1 indicate low correlation/similarity, while values close to 0 indicate high correlation/similarity.



groups each, and one quadrat was manually assigned to an additional VT. The final VT groupings, as well as the updated VT determination of the misclassified quadrat, are labelled in the dendrogram in **Appendix J**.

The review of the relevé data did not identify any additional VTs in the Survey Area. Relevé sites were therefore assigned to one of the eight VTs defined by the floristic classification analyses, following detailed investigation of their species composition, topography, soils, and geographic location. The locations of quadrats and/or relevés within each VT were used in conjunction with examination of aerial photography and field notes taken during the 2022 and Cooljarloo West surveys (presented in **Appendix G**) to develop VT mapping polygon boundaries across the Survey Area.

The eight VTs of the Survey Area are considered to belong to two broad vegetation groups based on soils and topography. These two groups correspond to the clusters within the two supergroups of the analysis dendrogram (**Appendix J**). These two groups are described further below:

- **Group 1** (prefix 'D' to indicate 'dry' vegetation types; VTs D-A to D-C):
 - Comprised of two broad vegetation types:
 - Banksia woodland to species-rich shrubland with emergent Banksia on undulating plains and dunes of deeper sand (VTs D-A and D-B). Mapped in areas from flats (not water gaining), plains, and lower slopes to upper slopes and dune crests. The majority of VTs D-A and D-B were mapped on areas with deeper sands, and in these areas the vegetation structure was characterised by woodlands dominated by a variety of *Banksia* species and *Eucalyptus todtiana*; however, areas of shallower sands with a higher clay content were also represented, where the structure of the vegetation consisted of species-rich mixed heath, often with occasional emergent *Banksia* trees, *Eucalyptus todtiana* or *Nuytsia floribunda*.
 - Proteaceous heathland on low rocky ironstone hills (VT D-C). Mapped in two small locations only.
 - o Generally corresponds to soil landscape subsystems Bassendean 1, 3 and 13 (Section 2.2).
- Group 2 (prefix 'W' to indicate 'wet' vegetation types; VTs W-A to W-E):
 - Comprised of multiple VTs consisting of occasional low isolated trees of a variety of species including *Melaleuca rhaphiophylla*, *Melaleuca preissiana* or *Banksia* spp. over Myrtaceous and Proteaceous heath on damp to wet lower slopes, plains, flats, open depressions and swamps.
 - Related to conditions of greater water availability; generally consists of vegetation associated with either wetland habitats (VTs W-B and W-C) or areas of higher moisture retention (i.e. soils with high clay content or impeding layer; VTs W-A, W-D and W-E).
 - Has a much higher diversity of VTs in comparison to group 1. This is due both to the more diverse landform and soil types in this group in comparison to group 1, and the higher diversity of species groupings of woodlands and heaths within these wetter areas in comparison to similar vegetation structures in drier areas.
 - Despite the high diversity of VTs in group 2, a number of taxa were fairly consistent in the group, including *Banksia telmatiaea*, *Regelia ciliata*, and to a lesser extent *Melaleuca seriata* and *Verticordia densiflora* var. *densiflora*.
 - o Generally corresponds to soil landscape subsystems Bassendean 2 and 5 (Section 2.2).



Table 5.8 presents a description of each of the eight VTs mapped in the Survey Area, including location, area mapped, sampling regime, significant flora recorded (for taxa recorded by the 2022 survey only; '^' denotes preferred habitat for a significant taxon), average taxon richness and a description of variation found within the VT. **Figure 5.6** presents an overview of the distribution of VTs. Raw quadrat and relevé data and parameters are presented in **Appendix G**. Detailed VT mapping with locations of sample sites established in the Survey Area are presented in **Appendix K**. **Appendix L** presents a taxon-VT matrix and **Appendix M** presents the results of the indicator taxa analysis.

In addition to the mapping of eight VTs, any roads, tracks, firebreaks and drill lines present in the Survey Area that were discernible at a 1:10,000 scale were mapped as 'Cleared Land'. If not discernible at this scale, these areas were mapped as parts of the VTs within which they occur; the majority of such areas were small in width and clearly very old, with vegetation observed to have regrown to some extent. A total of 13.6 ha of 'Cleared Land' was mapped in the Survey Area (representing 1 % of the total area of the Survey Area).

The large block of farmland in the southern part of the Survey Area was mapped as 'Not Assessed', representing 20.2 % of the Survey Area. This area is fenced and is stocked with livestock.



Table 5.8 Summary of VTs Described in the Survey Area

VT Summary

D-A

Description: Low woodland to isolated trees of *Banksia attenuata* and *Banksia menziesii*, occasionally with *Eucalyptus todtiana* and *Nuytsia floribunda*, over mid isolated shrubs of *Xanthorrhoea preissii*, over low shrubland to sparse shrubland of mixed species dominated

Xanthorrhoea preissii, over low shrubland to sparse shrubland of mixed species dominated by Bossiaea eriocarpa and Melaleuca clavifolia and also Hibbertia hypericoides subsp. hypericoides, Jacksonia nutans and Eremaea pauciflora var. pauciflora, over low sparse sedgeland and rushland of mixed species including Lepidosperma cf. pubisquameum, Alexgeorgea nitens and Mesomelaena pseudostygia, over low sparse forbland of mixed species including Dasypogon obliquifolius and Patersonia occidentalis var. occidentalis, on grey or brown deep sands or sandy loam on plains or flats within undulating plains and slopes of low dunes.

Location: Mapped over a number of relatively large occurrences in the Survey Area, particularly in the southern half of the Survey Area.

Area Mapped (Proportion of Survey Area): 238.8 ha (18.1 %).

Sample Sites: 10 quadrats (COOL55, NEW051, NEW070, NEW121, OLF08, OLF15, OLF31, OMP04, OMP05, OMP07), 5 relevés (LFGSR01, LFGSR02, LFGSR09, ROMP03, ROMP05).

Indicator Taxa: Alexgeorgea nitens, Amphipogon turbinatus, Banksia attenuata, Banksia menziesii, Bossiaea eriocarpa, Conostylis juncea, Dasypogon obliquifolius, Eremaea asterocarpa subsp. asterocarpa, Gompholobium tomentosum, Hypocalymma xanthopetalum, Jacksonia nutans, Melaleuca clavifolia, Petrophile linearis, Synaphea spinulosa subsp. spinulosa, Xanthosia huegelii.

Significant Taxa: *Hypocalymma quadrangulare* (P3)^, *Poranthera asybosca* (P1)^.

Average Taxon Richness per Quadrat: 42.2 ± 11.7 (native 41.0 ± 10.7).

Variation: There were minor differences in the composition of understorey taxa in the northern and southern occurrences of this VT in the Survey Area. In the northern quadrats, taxa including *Eremaea asterocarpa* subsp. *asterocarpa*, *Jacksonia hakeoides* and *Banksia dallanneyi* subsp. *dallanneyi* were common, but were replaced by *Eremaea pauciflora* var. *pauciflora*,

Representative Photo



Photo 5.15 VT D-A (quadrat COOL55)



VT	Summary	Representative Photo
D-A cont.	Calytrix flavescens and Scholtzia involucrata in the southern quadrats. These differences may be related to the influence of soils and geology, with the northern occurrences of VT D-A broadly corresponding to soil landscape subsystem Bassendean 3 (low dunefields; deep, pale grey or white sands), and the southern to Bassendean 1 (undulating to flat sandplain and minor swamps; pale to yellow deep sands) (Section 2.2).	
	Similar VTs: VT D-A is very similar to VT D-B, and can be difficult to differentiate in the field. VT D-A predominantly occurs on grey or brown sand (cf. yellow or brown for D-B, but sometimes also grey), is more species rich, usually has a slightly higher density of trees, and contains a number of understorey taxa that VT D-B does not (e.g. Alexgeorgea nitens, Conostylis juncea, Eremaea asterocarpa subsp. asterocarpa, Gompholobium tomentosum, Lepidosperma cf. pubisquameum, Melaleuca seriata, Synaphea spinulosa subsp. spinulosa and Xanthosia huegelii).	
D-B	Description: Low woodland to isolated trees of Banksia attenuata and Banksia menziesii, occasionally with Eucalyptus todtiana or Banksia prionotes, over mid open to sparse shrubland of mixed species dominated by Allocasuarina humilis, Eremaea pauciflora var. pauciflora, Acacia pulchella var. glaberrima and occasionally Hakea trifurcata and Xanthorrhoea preissii, over low open to sparse shrubland of mixed species dominated by Hibbertia hypericoides subsp. hypericoides, Conospermum stoechadis subsp. stoechadis, Hibbertia striata, Stirlingia latifolia and occasionally Petrophile macrostachya, over low sparse sedgeland and rushland of mixed species including Lepidobolus preissianus subsp. preissianus and Mesomelaena pseudostygia, on yellowbrown or grey deep sands or sandy loam on flats within undulating plains and slopes of low dunes. Location: Mapped over a number of occurrences throughout the Survey Area.	
	Area Mapped (Proportion of Survey Area): 108.9 ha (8.3 %).	
	Sample Sites: 6 quadrats (NEW113, OLF01, OLF05, OLF10, OLF11, OMP09), 1 relevé (OLF36).	Photo 5.16 VT D-B (quadrat OLF05)



VT	Summary	Representative Photo
D-B cont.	Indicator Taxa: Acacia pulchella var. glaberrima/var. reflexa, Allocasuarina humilis, Anigozanthos humilis subsp. humilis, Conospermum stoechadis subsp. stoechadis, Conostylis teretifolia subsp. teretifolia, Eremaea pauciflora var. lonchophylla/var. pauciflora, Hibbertia hypericoides subsp. hypericoides, Hibbertia striata, Laxmannia sessiliflora subsp. ?australis/subsp. sessiliflora, Lechenaultia linarioides, Lepidobolus preissianus subsp. preissianus, Mesomelaena pseudostygia, Petrophile macrostachya, Rytidosperma setaceum, Schoenus clandestinus, Thysanotus spiniger.	
	Significant Taxa: Hypocalymma quadrangulare (P3)^, Poranthera asybosca (P1)^, Stylidium hymenocraspedum (P3)^.	
	Average Taxon Richness per Quadrat: 36.3 ± 9.3 (native 34.0 ± 8.6).	
	Variation: In two quadrats (NEW113 and OLF01), Banksia prionotes replaced Banksia attenuata and Banksia menziesii in the tree stratum. These quadrats also had a slightly more diverse understorey comprising a number of taxa not recorded in other quadrats in the VT, including Hakea costata, Petrophile recurva, Caustis dioica, Isotropis cuneifolia subsp. cuneifolia and Stylidium purpureum, as well as a very high cover of Hakea trifurcata. NEW113 and OLF01 are the only quadrats in the Survey Area that occur in soil landscape subsystem Bassendean 13 (relict alluvial plain; grey or yellow/brown sandy duplexes and pale, yellow or brown deep sands) while the remainder of quadrats in VT D-B predominately correlate with the Bassendean 3 subsystem (low dunefields; deep, pale grey or white sands) (Section 2.2).	
	Similar VTs: Most similar to VT D-A; see that VT for discussion.	



VT	Summary	Representative Photo
D-C	Description: Mid open shrubland of mixed species dominated by <i>Hakea trifurcata</i> , <i>Banksia sessilis</i> var. <i>cygnorum</i> , <i>Xanthorrhoea preissii</i> and <i>Allocasuarina humilis</i> , over low sparse shrubland of mixed species dominated by <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i> and to a lesser extent <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i> , <i>Hakea prostrata</i> and <i>Hibbertia striata</i> , on red-brown clay loam with ironstone surface stones and outcropping on low rocky hills.	
	Location: Mapped in two small occurrences in the central eastern part of the Survey Area.	
	Area Mapped (Proportion of Survey Area): 0.8 ha (0.1 %).	
	Sample Sites: 1 quadrat (OLF12).	
	Indicator Taxa: NA (VT represented by a single quadrat).	
	Significant Taxa: None recorded.	Photo 5.17 VT D-C (quadrat OLF12)
	Average Taxon Richness per Quadrat: 31.0 (native 21.0).	
	Variation: NA (represented by a single quadrat).	
	Similar VTs: Not especially similar to any other VTs. VT D-C shares a small number of taxa in common with D-B, however can be differentiated by the strong ironstone influence and lack of tree stratum. In addition, the native taxa <i>Banksia sessilis</i> var. <i>cygnorum</i> , <i>Desmocladus asper</i> and <i>Daucus glochidiatus</i> were unique to quadrat OFL12 in the Survey Area	



W-A

Description: Occasional low isolated trees of Melaleuca rhaphiophylla over mid heathland to open heathland of mixed species including Melaleuca viminea subsp. viminea, Hakea varia, Melaleuca teretifolia and Viminaria juncea, over low sparse heathland of mixed species dominated by Verticordia densiflora var. densiflora, Melaleuca seriata and sometimes Hakea lissocarpha, Petrophile seminuda and Banksia telmatiaea, over low sparse sedgeland and rushland of mixed species dominated by Leptocarpus canus and Schoenus subfascicularis over low sparse forbland of mixed species including Patersonia occidentalis var. occidentalis, Opercularia vaginata and

seasonally damp to wet lower slopes, open depressions and clay pans.

Location: Mapped in a number of small occurrences in the central and southern parts of the Survey Area.

Conostylis aculeata subsp. breviflora, on sandy clay loam or clay loam of various colours on

Area Mapped (Proportion of Survey Area): 16.6 ha (1.3 %).

Sample Sites: 3 quadrats (COO-01, OMP01, OMP03), 2 relevés (ROMP01, ROMP02).

Indicator Taxa: Hakea lissocarpha, Leptocarpus canus, Opercularia vaginata, Verticordia densiflora var. densiflora.

Significant Taxa: Anigozanthos viridis subsp. terraspectans (T)^, Babingtonia urbana (P3)^.

Average Taxon Richness per Quadrat: 34.7 ± 16.6 (native 28.0 ± 15.1).

Variation: One quadrat (OMP03) had very high cover of tall and mid heath shrubs including *Melaleuca teretifolia* and *Melaleuca rhaphiophylla* (approx. 30 % and 8 %, respectively); these taxa were not recorded within the other two quadrats in this VT. This quadrat is located in an open depression and has a greater soil clay content compared to the sandy clay loam on lower slopes at the other quadrat locations. Hence, quadrat OMP03 is likely to be more water-gaining and thus able to support taxa such as *Melaleuca rhaphiophylla* that have a high water requirement (**Photo 5.19**).



Photo 5.18 VT W-A (quadrat OMP01)



W-A cont.

Similar VTs: VT W-A is most similar to W-B, but W-A is more species rich (particularly with respect to annual taxa), while W-B has a greater ironstone influence (albeit at depth), corresponding to the Bassendean 2 soil landscape subsystem (undulating sandplain and occasionally poorly drained depressions, with ironstone). VT W-A occurs throughout the central and southern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part of the Survey Area, while W-B is restricted to the northeastern part o



Representative Photo VT Summary W-B Description: Mid sparse heathland of mixed species including Verticordia plumosa var. brachyphylla and Melaleuca acutifolia, over low heathland of mixed species dominated by Regelia ciliata, Calothamnus hirsutus, Melaleuca seriata, Verticordia densiflora var. densiflora and Petrophile seminuda, on brown or grey sandy loam on seasonally damp undulating plains. Location: Predominately mapped along the northeastern boundary of the Survey Area, with another small occurrence on the northwestern boundary of the Survey Area. Area Mapped (Proportion of Survey Area): 13.5 ha (1.0 %). Sample Sites: 2 quadrats (LFGS01, LFGS02), 1 relevé (OLF37). Indicator Taxa: Acacia dilatata, Calothamnus hirsutus, Calytrix flavescens, Hakea sulcata, Lomandra hermaphrodita, Melaleuca seriata, Petrophile seminuda, Regelia ciliata, Scaevola anchusifolia, Stylidium dichotomum. Photo 5.20 VT W-B (quadrat LFGS02) **Significant Taxa:** *Isopogon panduratus* subsp. *palustris* (P3)^. Average Taxon Richness per Quadrat: 23.5 ± 4.9 (native 23.0 ± 5.7). Variation: There was little variation observed due to the limited sampling of this VT. Similar VTs: Most similar to VT W-A; see that VT for discussion.



VT Summary

W-C

Description: Occasional low open woodland to isolated trees of mixed species including *Nuytsia floribunda*, *Banksia menziesii*, *Banksia attenuata*, *Banksia prionotes* and *Melaleuca preissiana*, over mid closed to open heathland of mixed species dominated by *Banksia telmatiaea*, *Regelia ciliata*, *Hakea obliqua* subsp. *parviflora* and occasionally *Beaufortia squarrosa* and *Calytrix aurea*, over low heathland to sparse heathland of mixed species including *Melaleuca seriata*, *Verticordia densiflora* var. *densiflora*, *Isopogon panduratus* subsp. *palustris* (P3), *Acacia lasiocarpa* var. *lasiocarpa* and *Jacksonia hakeoides*, on grey, brown or yellow sandy loam or sand on seasonally damp to wet low-

Location: Mapped widely throughout the Survey Area, particularly in the northern half of the Survey Area.

Area Mapped (Proportion of Survey Area): 594.5 ha (45.0 %).

lying plains, flats, open depressions and swamps.

Sample Sites: 23 quadrats (COOL45, COOL58, LFGS04, LFGS05, LFGS06, LFGS09, LFGS10, NEW109, NEW120, OLF06, OLF07, OLF09, OLF13, OLF20, OLF21, OLF24, OLF28, OLF30, OMP02, OMP08, OMP10, OMP11, OMP13), 19 relevés (LFGS07, LFGSR04, LFGSR05, LFGSR06, LFGSR07, LFGSR08, LFGSR10, OLF02, OLF14, OLF19, OLF22, OLF27, OLF29, OLF32, OLF33, OLF34, OLF35, OLF38, ROMP04).

Indicator Taxa: Banksia telmatiaea, Beaufortia squarrosa, Hakea obliqua subsp. parviflora, Isopogon panduratus subsp. palustris (P3).

Significant Taxa: Anigozanthos viridis subsp. terraspectans (T), Babingtonia urbana (P3), Chordifex reseminans (P2)^, Conospermum scaposum (P3)^, Desmocladus nodatus (P3)^, Hypocalymma quadrangulare (P3), Isopogon panduratus subsp. palustris (P3)^, Lepyrodia curvescens (P2)^, Persoonia rudis (P3)^, Poranthera asybosca (P1), Schoenus griffinianus (P4)^, Verticordia lindleyi subsp. lindleyi (P4)^.

Average Taxon Richness per Quadrat: 22.7 ± 7.9 (native 21.8 ± 7.3).

Representative Photo



Photo 5.21 VT W-C (quadrat LFGS05)



Photo 5.22 Variant of VT W-C with large open patches (quadrat OLF06)



Representative Photo VT **Summary** W-C Variation: Given this VT was mapped widely across the Survey Area, there was considerable variation observed. The dominant taxa of this VT were generally very consistent, with some minor cont. compositional variation of other non-dominant taxa; however, there was significant structural variation, particularly in occurrences of this VT that contain somewhat transitional vegetation between lower-lying, wetter vegetation types, and the high, drier vegetation types, with these latter areas sometimes containing a *Banksia* tree layer. Occurrences of this VT in low-lying broad depressions experience longer periods of saturation, and often contain the hydrophilic species Babingtonia urbana (P3) and Melaleuca brevifolia. Narrow occurrences often had greater incursion of taxa typical of dry vegetation types, including Banksia menziesii, Eremaea asterocarpa subsp. asterocarpa and Hibbertia hypericoides subsp. hypericoides, and more open patches. However, these quadrats generally still contained the 'wet' taxa common to this VT, including Banksia telmatiaea, Regelia ciliata and Verticordia lindleyi subsp. lindleyi (P4). Low-lying wet areas with open patches were often dense herbfields (Photo 5.22). Quadrat OMP08 contained Banksia prionotes (approximately 12 % cover; Photo 5.23) but was otherwise similar to the typical VT W-C. **Photo 5.23** Variant of VT W-C with Banksia prionotes (quadrat OMP08) Similar VTs: VT W-C surrounds the majority of occurrences of all other wet VTs, and consequently shares species in common with these VTs. However, VT W-C is generally more species poor due to the high cover of heath shrubs; has low diversity of small shrubs, herbs and annual taxa; and generally has more sandy soils, corresponding to a general absence of clay pan specialist taxa.



Summary

W-D

Description: Occasional low isolated trees of *Melaleuca rhaphiophylla*, over mid heathland to open heathland of mixed species dominated by Melaleuca viminea subsp. viminea, Banksia telmatiaea, Regelia ciliata and occasionally Melaleuca acutifolia and Kunzea micrantha subsp. petiolata, over low open to sparse heathland of mixed species including Melaleuca brevifolia and Hakea varia, over low sparse sedgeland and rushland of mixed species including Chaetanthus aristatus and occasionally Gahnia trifida, on brown, grey or black clay loam or sandy loam on damp to wet plains, flats and open depressions.

Location: Predominately mapped in the northwestern part of the Survey Area, with a small number of small occurrences in the southern half of the Survey Area.

Area Mapped (Proportion of Survey Area): 47.4 ha (3.6 %).

Sample Sites: 8 quadrats (LFGS03, NEW023, OLF16, OLF17, OLF23, OMP06, OMP12, OMP14), 2 relevés (LFGSR03, OLF18).

Indicator Taxa: Cassytha aurea var. hirta, Chaetanthus aristatus, Melaleuca brevifolia, Melaleuca viminea subsp. viminea.

Significant Taxa: Grevillea cooljarloo (P1)^.

Average Taxon Richness per Quadrat: 20.8 ± 9.5 (native 16.8 ± 7.7).

Variation: Quadrat OLF17 is located in a small patch of vegetation with soils that were redder than typical, and with a small amount of ironstone outcropping and gravel (< 2 % cover) (Photo 5.25). However, the species composition and vegetation structure at this location did not differ greatly from the typical VT W-D.

Similar VTs: VT W-D is not especially similar to any other VTs. VT W-D shares some taxa in common with W-E, but is primarily dominated structurally by Melaleuca spp. It generally has large open patches with soil surface scalding, leaving obvious patches of clay on the soil surface; these bare patches typically did not support large herbfields as seen in other VTs.

Representative Photo



VT W-D (quadrat NEW023) Photo 5.24



Photo 5.25 Variant of VT W-D with minor ironstone influence and red-brown soils (quadrat OLF17)



W-E

Description: Occasional low isolated trees of Melaleuca rhaphiophylla, Eucalyptus rudis subsp.
rudis, Banksia littoralis and/or Banksia menziesii, over tall sparse to isolated shrubs of mixed species including Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602), Exocarpos sparteus and occasionally Viminaria juncea, Melaleuca incana subsp. incana and Hakea varia, over mid open to sparse heathland of Banksia telmatiaea and other species including Kunzea micrantha subsp. petiolata, Regelia ciliata, Melaleuca teretifolia and Hakea trifurcata, over low sparse shrubland of mixed species including Xanthorrhoea preissii, Hypocalymma balbakiae, Melaleuca viminea subsp. viminea and Acacia lasiocarpa var. lasiocarpa, on brown or grey clay loam or sandy loam on damp to wet

Location: Mapped in a small number of occurrences in the northeastern and central-eastern parts of the Survey Area.

Area Mapped (Proportion of Survey Area): 19.9 ha (1.5 %).

Sample Sites: 7 quadrats (LFGS08, NEW108, NEW112, OLF03, OLF04, OLF25, OLF26).

Indicator Taxa: Melaleuca rhaphiophylla.

flats or plains.

Significant Taxa: Isopogon panduratus subsp. palustris (P3).

Average Taxon Richness per Quadrat: 18.7 ± 8.0 (native 15.4 ± 5.9).

Variation: This VT was generally relatively species poor, but there was high diversity in the species composition of the dominant strata, and consequently also of the *vegeta*tion structure. For example, quadrat LFGS08 was structurally dominated by *Banksia telmatiaea* (1.1 m high, 25 % cover) interspersed with large open patches (**Photo 5.26**), whereas quadrats OLF26 and OLF04 (**Photo 5.27**) had occasional tree taxa and tall shrubs present.

Similar VTs: VT W-E has some compositional similarities to W-D; see that VT for discussion. Areas of VT W-E also have similarities to W-C, but are less species rich.

Representative Photo



Photo 5.26 Form of VT W-E with low, open vegetation structure (quadrat LFGS08)



VT	Summary	Representative Photo
W-E cont.		
		Photo 5.27 Form of VT W-E with open woodland and tall
		shrubland strata (quadrat OLF04)







Legend **Vegetation Type** D-A Low woodland to isolated trees of Banksia attenuata and Banksia menziesii, occasionally with Eucalyptus todtiana and Nuytsia floribunda, over mid isolated shrubs of Xanthorrhoea preissii, over low shrubland to sparse shrubland of mixed species dominated by Bossiaea eriocarpa and Melaleuca clavifolia and also Hibbertia hypericoides subsp. hypericoides, Jacksonia nutans and Eremaea pauciflora var. pauciflora, over low sparse sedgeland and rushland of mixed species including Lepidosperma cf. pubisquameum, Alexgeorgea nitens and Mesomelaena pseudostygia, over low sparse forbland of mixed species including Dasypogon obliquifolius and Patersonia occidentalis var. occidentalis, on grey or brown deep sands or sandy loam on plains or flats within undulating plains and slopes of low dunes. D-B Low woodland to isolated trees of Banksia attenuata and Banksia menziesii, occasionally with Eucalyptus todtiana or Banksia prionotes, over mid open to sparse shrubland of mixed species dominated by Allocasuarina humilis, Eremaea pauciflora var. pauciflora, Acacia pulchella var. qlaberrima and occasionally Hakea trifurcata and Xanthorrhoea preissii, over low open to sparse shrubland of mixed species dominated by Hibbertia hypericoides subsp. hypericoides, Conospermum stoechadis subsp. stoechadis, Hibbertia striata, Stirlingia latifolia and occasionally Petrophile macrostachya, over low sparse sedgeland and rushland of mixed species including Lepidobolus preissianus subsp. preissianus and Mesomelaena pseudostygia, on yellow-brown or grey deep sands or sandy loam on flats within undulating plains and slopes of low dunes. D-C Mid open shrubland of mixed species dominated by Hakea trifurcata, Banksia sessilis var. cygnorum, Xanthorrhoea preissii and Allocasuarina humilis, over low sparse shrubland of mixed species dominated by Calothamnus quadrifidus subsp. angustifolius and to a lesser extent Hibbertia hypericoides subsp. hypericoides, Hakea prostrata and Hibbertia striata, on red-brown clay loam with ironstone surface stones and outcropping on low rocky hills. W-A Occasional low isolated trees of Melaleuca rhaphiophylla over mid heathland to open heathland of mixed species including Melaleuca viminea subsp. viminea, Hakea varia, Melaleuca teretifolia and Viminaria juncea, over low sparse heathland of mixed species dominated by Verticordia densiflora var. densiflora, Melaleuca seriata and sometimes Hakea lissocarpha, Petrophile seminuda and Banksia telmatiaea, over low sparse sedgeland and rushland of mixed species dominated by Leptocarpus canus and Schoenus subfascicularis over low sparse forbland of mixed species including Patersonia occidentalis var. occidentalis, Opercularia vaginata and Conostylis aculeata subsp. breviflora, on sandy clay loam or clay loam of various colours on seasonally damp to wet lower slopes, open depressions and clay pans. W-B Mid sparse heathland of mixed species including Verticordia plumosa var. brachyphylla and Melaleuca acutifolia, over low heathland of mixed species dominated by Regelia ciliata, Calothamnus hirsutus, Melaleuca seriata, Verticordia densiflora var. densiflora and Petrophile seminuda, on brown or grey sandy loam on seasonally damp undulating plains. W-C Occasional low open woodland to isolated trees of mixed species including Nuytsia floribunda, Banksia menziesii, Banksia attenuata, Banksia prionotes and Melaleuca preissiana, over mid closed to open heathland of mixed species dominated by Banksia telmatiaea, Regelia ciliata, Hakea obliqua subsp. parviflora and occasionally Beaufortia squarrosa and Calytrix aurea, over low heathland to sparse heathland of mixed species including Melaleuca seriata, Verticordia densiflora var. densiflora, Isopogon panduratus subsp. palustris (P3), Acacia lasiocarpa var. lasiocarpa and Jacksonia hakeoides, on grey, brown or yellow sandy loam or sand on seasonally damp to wet low-lying plains, flats, open depressions and swamps. W-D Occasional low isolated trees of Melaleuca rhaphiophylla, over mid heathland to open heathland of mixed species dominated by Melaleuca viminea subsp. viminea, Banksia telmatiaea, Regelia ciliata and occasionally Melaleuca acutifolia and Kunzea micrantha subsp. petiolata, over low open to sparse heathland of mixed species including Melaleuca brevifolia and Hakea varia, over low sparse sedgeland and rushland of mixed species including Chaetanthus aristatus and occasionally Gahnia trifida, on brown, grey or black clay loam or sandy loam on damp to wet plains, flats and open depressions. W-E Occasional low isolated trees of Melaleuca rhaphiophylla, Eucalyptus rudis subsp. rudis, Banksia littoralis and/or Banksia menziesii, over tall sparse to isolated shrubs of mixed species including Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602), Exocarpos sparteus and occasionally Viminaria juncea, Melaleuca incana subsp. incana and Hakea varia, over mid open to sparse heathland of Banksia telmatiaea and other species including Kunzea micrantha subsp. petiolata, Regelia ciliata, Melaleuca teretifolia and Hakea trifurcata, over low sparse shrubland of mixed species including Xanthorrhoea preissii, Hypocalymma balbakiae, Melaleuca viminea subsp. viminea and Acacia lasiocarpa var. lasiocarpa, on brown or grey clay loam or sandy loam on damp to wet flats or plains. Cleared Land Cleared Land Not Assessed Not Assessed

FIGURE 5.6

LEGEND: Overview of Vegetation Types of the Survey Area

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5.2.6 Comparison of Vegetation Types with Cooljarloo West Vegetation Types

5.2.6.1 Local Scale

Table 5.9 presents a summary comparison of the Survey Area VTs as defined by the current survey with those defined and mapped for the Cooljarloo West survey; this summary considers the mapping boundaries from the two surveys, and the grouping of existing quadrats in the floristic clustering analysis dendrogram that was used to define VTs in the Survey Area (i.e. analysis two; **Section 5.2.5**).

As per **Table 5.9** and within the Survey Area, seven of the eight VTs as defined by the current assessment are considered possibly equivalent to Cooljarloo West VTs. VT D-C has little similarity to any particular Cooljarloo West VT; given this VT was mapped across a small extent and low number of occurrences, it is likely that the sampling scale of the Cooljarloo West survey was too coarse to adequately capture this VT within the Survey Area.

Table 5.9 Possible Local Scale Similarity of Survey Area VTs to Cooljarloo West VTs

Survey Area VT	Representative CLW Quadrat(s)	Potentially Equivalent CLW VT(s)	Comments
D-A	COOL55 NEW051 NEW070 NEW121	17	Three of the four representative CLW quadrats were previously classified as CLW VT 17; quadrat NEW051 was previously classified as CLW VT 18. Mapping boundaries in the Survey Area and species composition of VT D-A and CLW VT 17 are broadly similar, although VT 17 was also mapped in transitional areas that have been mapped by this current assessment as VT W-C, e.g. areas with occasional Banksia trees over a wet heath understorey.
D-B	NEW113	18	Quadrat NEW113 was previously classified as CLW VT 18. Mapping boundaries in the Survey Area and species composition of VT D-B and CLW VT 18 are broadly similar, although some areas mapped as VT 18 were considered representative of VT D-A.
D-C	-	-	VT D-C represented by a single, newly established quadrat. Area mapped as VT D-C was previously mapped in the Survey Area as CLW VT 6, but the vegetation in this area does not correspond with VT 6 (Banksia woodland over wet heath in damp depressions). No other CLW VTs correlate well with VT D-C at the local scale; sampling scale of CLW survey likely too coarse to capture this VT, which has a restricted extent in the Survey Area.
W-A	COO-01	2	Quadrat COO-01 was previously classified as CLW VT 2; however, occurrences of VT W-A as mapped by this current assessment were previously mapped in the Survey Area as a variety of CLW VTs, including 1, 2, 9b, 17 and 18. CLW VTs 17 and 18 (i.e., dry Banksia woodland) not considered equivalent given VT W-A occurs on damp to wet clayey areas, including in clay pans. Species composition and landform/soil characteristics of VT W-A are broadly similar to those of CLW VT 2.



Survey Area VT	Representative CLW Quadrat(s)	Potentially Equivalent CLW VT(s)	Comments
W-B	-	2	VT W-B represented by two newly established quadrats; no CLW quadrats classified in this grouping.
			Mapping boundaries in the Survey Area of VT W-B and CLW VT 7 are broadly similar, but the vegetation in this area does not correspond with VT 7 (low dry heath with surface or underlying laterite).
			There are similarities between the composition and landform/soil characteristics of VT W-B and CLW VT 2.
W-C	COOL45 COOL58	1, 5	All four representative CLW quadrats were previously classified as CLW VT 1.
	NEW109 NEW120		Mapping boundaries in the Survey Area and species composition of VT W-C are broadly similar to those of CLW VTs 1 and 5; these two CLW VTs were described by Woodman Environmental (2014b) as being very similar, and in the absence of hydrophilic species in the wetter VT 1, were apparently difficult to discern in the field and from aerial imagery.
W-D	NEW023	2	Quadrat NEW023 was previously classified as CLW VT 2. Mapping boundaries in the Survey Area, species composition and landform/soil characteristics of VT W-D are broadly similar to those of CLW VT 2.
W-E	NEW108 NEW112	9a, 9b	Quadrat NEW108 was previously classified as CLW VT 1, and quadrat NEW112 as VT 9a. Occurrences of VT W-E as mapped by this current assessment were previously mapped in the Survey Area as a variety of CLW VTs, including 1, 2, 9a, 9b and 12. Of these, species composition of VT W-E is broadly similar to those of CLW VTs 9a and 9b.

5.2.6.2 Regional Scale

As described in **Section 3.8**, further floristic analysis was undertaken to identify possible relationships and assess similarities between Survey Area VTs defined by the current assessment with Cooljarloo West VTs described by Woodman Environmental (2014b), with the aim of determining the potential regional distribution and significance of Survey Area VTs (i.e. analysis three). Additionally, taxon lists of quadrats from the Survey Area were also compared to the typical and common taxa lists for Cooljarloo West VTs, as well as soils, topography and geographical distribution data from the Cooljarloo West study. The resultant dendrogram, taxon group matrix and 2D cluster plot are presented in **Appendix N**, and detailed summaries of the combined dataset analysis results and comparisons are presented in **Appendix O**. Cooljarloo West VT descriptions are presented in **Appendix O**.

The clustering of quadrats as per the Cooljarloo West Survey classification analysis (Woodman Environmental, 2014b) were generally maintained in the analysis with the Survey Area quadrat dataset. However, with the addition of new quadrat data, there was migration of some quadrats and quadrat groups from their original positions. This was to be expected, given the addition of floristic data from 47 new quadrats to the analysis, resulting in a re-definition of relationships between quadrats. In addition, there have been a number of taxonomic changes since the original analysis that relate to taxa in the area, necessitating changes to the original quadrat data (**Appendix A**). This migration may also have been a result of quadrat positioning with respect to community boundaries, where edge effects (ecotones) influenced



the species composition of the quadrat. In addition, quadrats located in areas with characteristics that do not support the full complement of indicator species for a given VT would be expected to migrate more readily. For example, quadrats established in small wetlands may not contain all indicator species typical of larger wetlands.

Summaries of the analysis results, critical review and final determinations of possible regional scale similarity of Survey Area VTs to Cooljarloo West VTs are presented in **Table 5.10**. These determinations reflect the possible local scale similarities as per **Section 5.2.6.1**, with the addition of VTs D-C and W-A being identified as having minor to moderate regional similarity to Cooljarloo West VTs 8 and 2, respectively.

The Cooljarloo West assessment determined and described VTs at a higher-level scale in comparison to those presented in this report for the Survey Area. As a result, multiple Survey Area VTs have shown similarity to the same Cooljarloo West VT. In addition, many two Survey Area VTs have shown similarity to more than one Cooljarloo West VT (**Table 5.10**).

The cluster of quadrats that comprised Cooljarloo West VTs 1 and 2 were disrupted to the greatest extent by analysis three, with quadrats representing these two VTs spread throughout the first cluster of the dendrogram. Quadrats representing Survey Area VT W-C were also spread throughout the first cluster of the dendrogram to some extent, however were generally grouped with quadrats from Cooljarloo West VTs 1 and 5 (page 4 of **Appendix N**). The remaining 'wet' Survey Area VTs W-A, W-B, W-D and W-E grouped together with other quadrats of the same Survey Area VT, and generally with quadrats representing Cooljarloo West VT 2 (with the exception of VT W-E), suggesting that these Survey Area VTs may represent local variants of regional VT 2. It is unsurprising that Survey Area quadrats showed high similarity to other Survey Area quadrats. This is particularly the case for VTs mapped in low number of occurrences and small extents (e.g. VTs W-A and W-B), given the finer sampling scale within the Survey Area compared to that which was possible in the Cooljarloo West Study Area, which is almost four times larger and located in an area of very high turnover of species and vegetation communities.

The relationship of the single quadrat representing Survey Area VT D-C to Cooljarloo West VTs was not clear. There were some minor similarities between the species composition of VT D-C and Cooljarloo West VT 8, despite the latter being a coastal vegetation type with the yellow sands, limestone influence and species composition congruent with the coastal limestone formation and geology of the Guilderton and Jurien VSAs (**Table 5.10**). By comparison, Survey Area VT D-C occurs on red-brown clay loam with ironstone surface stones and outcropping on low rocky ironstone hills. The composition similarities of these two VTs are therefore likely due to the two VTs occurring on rocky habitats.



Table 5.10 Possible Regional Scale Similarity of Survey Area VTs to Cooljarloo West VTs

Survey Area VT	Positioning of Quadrats in Dendrogram	Critical Review of VT Characteristics	Determination
D-A	 7 quadrats representing VT D-A (70 %) classified within a large group of quadrats predominately representing CLW VT 17 (pages 6 and 7 of Appendix N). 3 quadrats representing VT D-A (30 %) classified within a large group of quadrats predominately representing CLW VT 18 (page 8 of Appendix N). 	 VT D-A and CLW VTs 17 and 18 occur on similar soils and landforms (dry deep sands plains and slopes of low dunes). VT D-A shares seven indicator taxa with CLW VT 17 (70 % of indicator taxa for VT 17) and one with VT 18 (14 %). The average native perennial taxon richness per quadrat (excluding singletons) for VT D-A (33.2) is more similar to that of CLW VT 17 (37.3) than that of VT 18 (25.8). The species composition of VT D-A has high similarity to that of CLW VT 17. 	High similarity to CLW VT 17
D-B	6 quadrats representing VT D-B (100 %) classified within a large group of quadrats predominately representing CLW VT 18 (pages 7 and 8 of Appendix N).	 VT D-B and CLW VT 18 occur on similar soils and landforms (dry deep sands in open depressions and flats within undulating plains). VT D-B shares six indicator taxa with CLW VT 18 (86 % of indicator taxa for VT 18). The average native perennial taxon richness per quadrat (excluding singletons) for VT D-B (25.8) is significantly lower than that of CLW VT 18 (40.1); however, two forms of CLW VT 18 were identified, but the taxon richness of the two forms were not provided separately. The species composition of VT D-B has high similarity to that of CLW VT 18. 	High similarity to CLW VT 18



Survey Area VT	Positioning of Quadrats in Dendrogram	Critical Review of VT Characteristics	Determination
D-C	Single quadrat representing VT D-C classified within a small group of quadrats representing a variety of CLW VTs, including 6, 8, 10 and 17. The next most closely related group of quadrats represent CLW VT 7 (page 6 of Appendix N).	 VT D-C occurs on low rocky ironstone hills, whereas CLW VTs 6, 7, 10 and 17 occur on damp to dry depressions, drainage lines and undulating plains, and VT 8 occurs on limestone dunes and ridges. Within the wider Cooljarloo West Study Area, one patch of vegetation that is potentially equivalent to VT D-C (via aerial imagery interpretation), approximately 1.2 km west of the main occurrence of VT D-C, was mapped as CLW VT 7. VT D-C is represented by a single quadrat, and therefore indicator species analyses could not be undertaken for this VT. However, taxa that were recorded at the D-C quadrat but at no other quadrats in the Survey Area include Banksia sessilis var. cygnorum and Desmocladus asper. Banksia sessilis var. cygnorum was recorded in CLW VTs 1 and 8, while Desmocladus asper was recorded in CLW VTs 7, 8 and 17. Both are indicator taxa for CLW VT 8. The average native perennial taxon richness per quadrat (excluding singletons) for VT D-C (11.0) is significantly lower than that of CLW VT 8 (38.7). VT D-C has some similarities VT 8, likely due to the two VTs occurring on rocky habitats. However, VT 8 is a coastal vegetation type with the yellow sands, limestone influence and species composition congruent with the coastal limestone formation and geology of the Guilderton and Jurien VSAs (DPIRD, 2019b). 	Some minor similarities to CLW VT 8 due to the rocky nature of the two VTs
W-A	 2 quadrats representing VT W-A (67 %) classified in a small group of quadrats representing CLW VTs 1 and 2, along with the two quadrats that represent VT W-B. The next most closely related group of quadrats predominately represent CLW VT 1, but also 6 and 9a (page 4 of Appendix N). 1 quadrat representing VT W-A (33 %) classified in a small group of quadrats representing CLW VTs 1, 2 and 9b. The next most closely related group is a large group of quadrats representing CLW VT 1 (page 4 of Appendix N). 	 VT W-A and CLW VTs 1, 2, 6, 9a and 9b occur on similar soils and landforms (sandy loam or sandy clay in broad damp to wet depressions, shallow basins, wet flats and drainage lines). VT W-A shares one indicator taxon with CLW VT 7 (17 % of indicator taxa for VT 7) and one with VT 8 (4 %). However, VTs 7 and 8 are not considered equivalent given they comprise low dry heaths associated with surface or underlying laterite and limestone, respectively. The average native perennial taxon richness per quadrat (excluding singletons) for VT W-A (15.7) is most similar to those of CLW VTs 1 (16.9) and 2 (16.5), with those of VTs 6, 9a and 9b being much higher or lower. The species composition of VT W-A is more similar to that of CLW VT 2 than of VT 1. It is possible that VT W-A represents a slightly wetter, more clayey version of VT 2 at the local scale. 	Moderate similarity to CLW VT 2



Survey Area VT	Positioning of Quadrats in Dendrogram	Critical Review of VT Characteristics	Determination
W-B	2 quadrats representing VT W-B (100 %) classified in a small group of quadrats representing CLW VTs 1 and 2, along with two of the three quadrats that represent VT W-A. The next most closely related group of quadrats predominately represent CLW VT 1, but also 6 and 9a (page 4 of Appendix N).	 VT W-B and CLW VTs 1, 2, 6 and 9a occur on similar soils and landforms (sandy loam or sandy clay in broad damp to wet depressions, shallow basins, wet flats and drainage lines). VT W-B shares one indicator taxon with CLW VT 3 (50 % of indicator taxa for VT 3) and one with VT 5 (also 50 %). The mapped occurrences of VT W-B generally correspond to the Bassendean 2 soil landscape subsystem, which extends slightly into the Survey Area from the northeast. This subsystem occurs much more widely in the wider Cooljarloo West Study Area, over which CLW VTs 1, 2, 5 and 6 have been mapped at moderate extents. These CLW VTs have also been mapped on other soil landscape subsystems. The average native perennial taxon richness per quadrat (excluding singletons) for VT W-B (15.5) is most similar to those of CLW VTs 1 (16.9) and 2 (16.5), with those of VTs 3, 6 and 9a being much higher or lower. The species composition of VT W-B has high similarity to that of CLW VT 2. 	High similarity to CLW VT 2
W-C	The 23 quadrats representing VT W-C were scattered throughout the first cluster of the dendrogram. The quadrats predominately grouped with CLW VT 1 quadrats, and to a lesser extent VT 5, with some lesser affinity to quadrats representing CLW VTs 2 and 6, as well as two of the eight quadrats representing VT W-D (pages 4 and 5 of Appendix N).	 VT W-C and CLW VTs 1 and 5 occur on similar soils and landforms (sand or sandy loam in broad, seasonally damp to wet plains and flats). VT W-C shares one indicator taxon with CLW VT 5 (50 % of indicator taxa for VT 5). The average native perennial taxon richness per quadrat (excluding singletons) for VT W-C (18.1) is similar to those of CLW VTs 1 (16.9), but slightly less than that of VT 5 (26.9). However, there is crossover of the taxon richness values of VTs W-C and 5 when taking into account the standard deviation (5.9 and 7.6, respectively). The species composition of VT W-C has high similarity to those of CLW VTs 1 and 5. 	High similarity to VTs 1 and 5



Survey Area VT	Positioning of Quadrats in Dendrogram	Critical Review of VT Characteristics	Determination
W-D	 6 quadrats representing VT W-D (75 %) classified within a group of quadrats representing CLW VTs 1, 2 and 9a. The next most closely related group of quadrats is a small group representing CLW VTs 1, 2, 4 and a single quadrat representing VT W-E (pages 4 and 5 of Appendix N). 2 quadrats representing VT W-D (25 %) classified within a small group of quadrats representing CLW VT 1. This group is sister to a large group of quadrats representing VT W-C and CLW VT 1, with the exception of a single quadrat representing CLW VT 2 (page 4 of Appendix N). 	 VT W-D and CLW VTs 1, 2, 4 and 9a occur on similar soils and landforms (sandy loam or clay loam in broad damp to wet depressions, shallow basins and flats). VT W-D shares two indicator taxa with CLW VT 2 (50 % of indicator taxa for VT 2), one with VT 8 (4 %), and one with VT 9a (50 %). However, CLW VT 8 is not considered equivalent given it comprises coastal heath on limestone. The vegetation patterning (from aerial imagery) of VTs W-D and VT 2 is extremely similar, with the mapped boundaries of CLW VT 2 clearly representing an extension of those of VT W-D as this patterning extends outside the Survey Area. The species composition of VT W-D has high similarity to that of CLW VT 2. 	High similarity to CLW VT 2
W-E	 6 quadrats representing VT W-E (86 %) classified within a small group of quadrats from CLW VTs 1, 2 and 11. This group is sister to a group of quadrats predominately representing CLW VTs 1, 2 and VT W-D, with single quadrat each from CLW VTs 4 and 9a (pages 4 and 5 of Appendix N). 1 quadrat representing VT W-E (14 %) classified in a small group of quadrats representing CLW VTs 1, 2 and 4. The next most closely related group is a group of quadrats representing VT W-D and CLW VTs 1, 2 and 9a (pages 4 and 5 of Appendix N). 	 VT W-E and CLW VTs 1, 2, 4, 9a and 11 occur on similar soils and landforms (sandy loam or clay loam in broad damp to wet flats, plains, depressions and drainage lines). The single indicator taxon for VT W-E, Melaleuca rhaphiophylla, is not an indicator taxon for any CLW VTs. However, it is a 'common taxon' for VTs 1, 2, 9a, 9b, 11 and 12. The average native perennial taxon richness per quadrat (excluding singletons) for VT W-E (9.4) is similar to those of CLW VTs 4 (9.0), 9a (6.6), 9b (4.9), 11 (8.0) and 12 (6.5). CLW VTs 4 and 11 were mapped across small extents in few occurrences, more than 5.5 km from the Survey Area. The Survey Area intersects the mapped distributions of all other CLW VTs identified above. The species composition of VT W-E has high similarity to those of CLW VTs 9a and 9b. 	High similarity to CLW VTs 9a and 9b



5.2.7 Significant Vegetation

5.2.7.1 Listed Significant Vegetation

The desktop assessment identified three listed significant vegetation communities that have records (or could potentially occur) within the Desktop Study Area (**Section 5.1.5**). Of these, the 'Banksia Woodlands of the Swan Coastal Plain' TEC is considered to occur in the Survey Area.

The 'Banksia Woodlands of the Swan Coastal Plain' is listed as a P3 PEC in WA, and as an Endangered TEC under Commonwealth legislation. DBCA state that the description, area and condition thresholds that apply to the EPBC-listed TEC also apply to the PEC (DBCA, 2023d); therefore, these are discussed together in the context of the EPBC-listed TEC. Note that a number of other DBCA-listed TECs and PECs (based on SCP FCTs from the Gibson et al. (1994) study) also form part of the EPBC-listed TEC on the southern SCP; these other communities are discussed in the **Section 5.2.7.2**.

The 'Banksia Woodland of the Swan Coastal Plain' TEC is an ecological community largely confined to the Perth and Dandaragan Plateau IBRA subregions of the SCP IBRA region, extending from near Jurien in the north to Dunsborough in the south, as well as in immediately adjacent pockets on the Whicher and Darling Scarps. The TEC is mainly located on the deep Bassendean and Spearwood sands, and occasionally Quindalup sands (typically on the eastern edge), on shallow sands overlying more complex stratigraphic sequences on the foothills of the Ridge Hill Shelf, Whicher Scarp and Gingin/Dandaragan Scarp. This TEC occurs within an annual rainfall band of approximately 535 to 900 mm, often with summer droughts and high temperatures. This strong seasonal variation in climate results in the TEC being a fire-prone environment, and therefore supports species with a range of life history traits that allow them to persist in fire-prone environments (DoEE, 2016).

This TEC was once continuously distributed across a large region. Currently, it is fragmented into numerous small and scattered patches. It was ranked under Criterion 1 (Decline in geographic distribution) as eligible for listing as Vulnerable; under Criterion 2 (small geographic distribution coupled with demonstratable threat) as eligible for listing as Endangered; and under Criterion 4 (Reduction in community integrity) as eligible for listing as Endangered (DoEE, 2016). Critical habitat for the TEC includes all patches that meet the diagnostic characteristics and condition thresholds for the community, as well as buffer zones, particularly where these zones contain native vegetation. Areas that do not meet minimum condition threshold may also be critical to the survival of the TEC depending upon factors such as size and shape and linkages. As of March 2019, approximately 22.5 % of the extant extent of the TEC in the Perth IBRA subregion was in lands managed for conservation (IUCN category I-IV reserves) (DoEE, 2016).

The Approved Conservation Advice for this community (DoEE, 2016) stipulates a stepwise process for identifying occurrences of the TEC community, as presented in **Appendix O**. These steps are followed in the context of identifying whether vegetation of the Survey Area represents this TEC, as outlined below.

The first step involves key diagnostic characteristics (location and physical environment, soils and landform, structure, and composition). The Survey Area satisfies the first two key diagnostic characteristics, as it occurs within the SCP IBRA bioregion (albeit at the very northern end), and contains areas of well drained, low nutrient soils on sandplain landforms. With regard to the remaining two key diagnostic characteristics, only VTs D-A and D-B are considered to possess these characteristics, as these areas almost always has a basic structure that includes a low woodland dominated by *Banksia attenuata* and *Banksia menziesii* (sometimes also with *Banksia prionotes*, and other emergent trees such as *Eucalyptus todtiana* and/or



Nuytsia floribunda), over a relatively diverse understorey that includes sclerophyllous shrubs and a herbaceous ground layer. It is acknowledged that in some of these areas, Banksia attenuata and/or Banksia menziesii are not dominant, and may occur as isolated trees only, or may be completely absent. However, as outlined in the Approved Conservation Advice under the fourth step of the identification process (further information to assist in determining the presence of the community), this form variation often occurs in patches of the TEC, and therefore does not preclude such areas from being included as part of a larger occurrence of the TEC. Note that while Banksia menziesii is present in some areas of VTs W-C and W-E, it is not dominant or co-dominant in the upper layer, and these VTs occur on poorly draining soils, and thus these VTs do not satisfy the mandatory criteria 3b and 2a respectively. Therefore, these areas are not considered to be occurrences of the TEC.

The next steps involve applying condition and size (spatial area) thresholds to potential patches of vegetation that meet the key diagnostic characteristics; a patch is defined as a discrete and mostly continuous area of the TEC, typically with any breaks (i.e. tracks, roads, or vegetation that does not represent the TEC, being less than 30 m in distance). Where there is a break in native vegetation cover from the edge of the tree canopy of 30 m or more (e.g. due to permanent artificial structures, wide roads or other barriers; or due to water bodies typically more than 30 m wide) then the gap typically indicates that separate patches are present. A total of 28 potential patches of the Banksia Woodland TEC were defined within the Survey Area using this definition; this was determined taking into account any patches of vegetation that are intersected by the Survey Area boundary but clearly form part of contiguous vegetation outside the Survey Area, via both aerial imagery interpretation and boundaries of Cooljarloo West VTs 17 and 18 (which are considered equivalent to VTs D-A and D-B; **Section 3.8**).

The Approved Conservation Advice then specifies that a patch of the TEC must meet the 'Good' vegetation condition category as per Gibson et al. (1994) to be considered a patch of the TEC under the EPBC Act; this is the same vegetation condition scale presented in EPA Technical Guidance (2016b) that has been used by this current assessment. It then defines minimum patch sizes for each condition rating (Good and higher). However, as outlined under the fourth step of the Approved Conservation Advice, it is stipulated that a patch can vary in condition, and can include vegetation with a lower condition rating than Good; such areas may still retain important natural values and may be critical to protecting those portions of a patch that meet the condition threshold. In these cases, the condition rating mapped over the largest portion of the patch has been used when assessing the patch against the minimum patch size requirements. It also stipulates that vegetation occurring outside of the area of study, in this case the Survey Area, needs to be considered when calculating patch sizes within the area of study, in cases where vegetation outside the area of study is contiguous with that inside. As aforementioned, this was also considered when determining the number and size of potential patches.

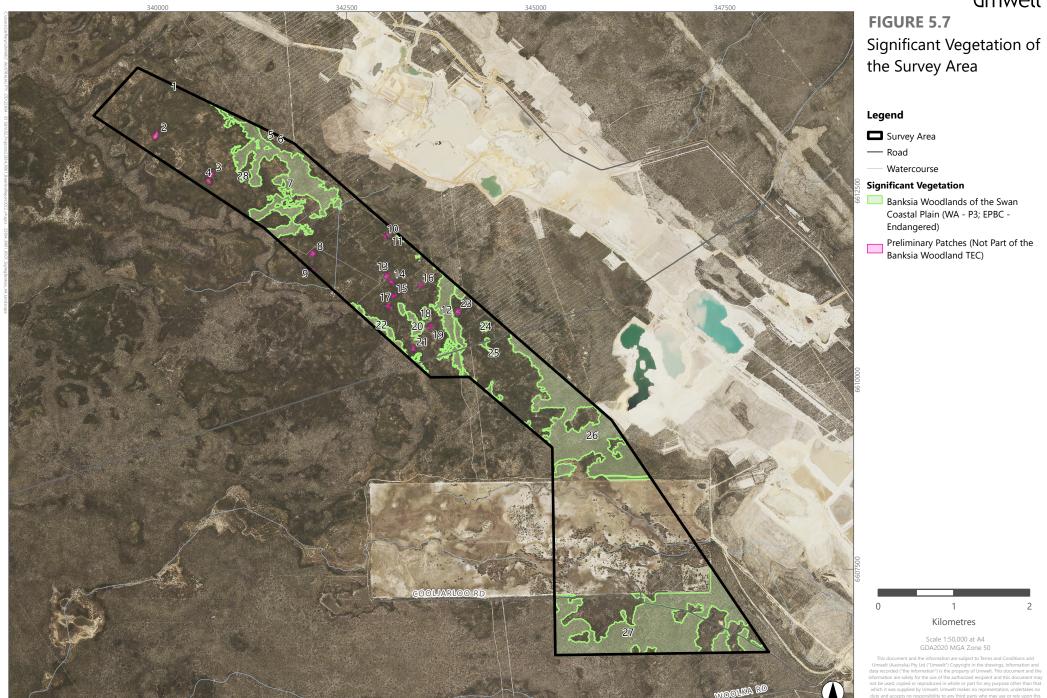
The assessment of the 28 potential patches against the key diagnostic characteristics is presented in **Appendix P**. In summary, 13 patches of the TEC are considered to occur within the Survey Area, as presented in **Figure 5.7**; of these, 10 patches met both the patch size and vegetation condition criteria, while three patches did not meet the patch size criteria for their mapped extents in the Survey Area, but they represent vegetation that is contiguous with the occurrence of the TEC immediately outside the Survey Area. The remaining 15 patches do not meet the patch size criteria, and are not considered to contribute significantly to the overall function of the ecological community; they are therefore not considered to be patches of the TEC.

The 13 patches of the TEC comprise a total area of 344.96 ha. No patches (either wholly or partially) of the TEC were considered to be in 'Pristine' condition, or in condition worse than 'Good'.



The 'Banksia Woodlands of the Swan Coastal Plain' TEC is already known to occur within the Survey Area based on records from DBCA's TEC and PEC Database (DBCA, 2021a). As mentioned in **Section 5.1.5**, the records provided by this search are generally polygons that were determined by overlaying broad-scale vegetation over remnant vegetation polygons. Ground-truthing by DBCA has not been undertaken to confirm occurrences in this dataset in most cases, and they are therefore considered to be indicative only, with on-ground assessment required to determine the actual extent of the TEC (if it is present at all). Therefore, the TEC as presented in **Figure 5.7** is considered to represent a more accurate extent than the occurrences contained in DBCA's TEC and PEC database. Consequently, no attempt has been made to correlate the extent of the TEC as defined above and presented in **Figure 5.7** with these occurrences.







5.2.7.2 Floristic Community Types of the Southern Swan Coastal Plain

The vegetation described by the study of the southern SCP by Gibson et al. (1994), together with supplementary vegetation description published by the Government of Western Australia (2000) (with the latter dataset being made available by Keighery et al. (2012)), is the current baseline used when assessing the significance of vegetation on the southern SCP (as per DBCA's *Vegetation survey methods and analysis to determine floristic community types on the southern Swan Coastal Plain* (DBCA, 2023c)). The vast majority of terrestrial TECs and PECs that occur on the southern SCP are Floristic Community Types (FCTs) described by the Gibson et al. (1994) study. This includes multiple FCTs that form components of the 'Banksia Woodland of the Swan Coastal Plain' and 'Clay pans of the Swan Coastal Plain' TECs.

The quadrat datasets associated with both of these studies sampled throughout the southern SCP, and included some upland sites associated with the Darling Scarp. However, the studies did not go as far north on the SCP as the Survey Area, which is located on the very northeastern end of the SCP. Given the SCP and Geraldton Sandplains regions have a very high turnover of species and vegetation communities, it is highly likely the vegetation of the Survey Area is not well represented in the SCP dataset. Therefore, it is not considered appropriate to undertake floristic analyses with the SCP datasets, or otherwise draw comparisons between the vegetation of the Survey Area and the FCTs of the southern SCP.

5.2.7.3 Other Significant Vegetation

An assessment of the potential local and regional significance of VTs of the Survey Area is presented in **Table 5.11**. Also presented in **Table 5.11** is the mapped area of each VT in the Survey Area (presented as a proportion of the total area of the Survey Area).

As discussed in **Section 5.2.7.1**, VTs D-A and D-B are considered representative of the 'Banksia Woodland of the Swan Coastal Plain' TEC and are consequently considered significant in a regional context. An additional two VTs (VTs D-C and W-A) are considered potentially significant in a local and regional context for reasons other than formal listing, as per EPA guidance (2016a, 2016b) (**Section 3.10.2**).



Table 5.11 Assessment of Potential Local and Regional Significance of VTs of the Survey Area

VT	% of Survey	Summary of Potential Significance		
	Area	Local Context	Regional Context (with Reference to CLW VTs)	
D-A	18.1	 Not considered significant in a local context Mapped over many large occurrences in the Study Area. Does not occur on a restricted landform. Not restricted in the Survey Area. 	 Considered significant in a regional context Forms part of the 'Banksia Woodland of the Swan Coastal Plain' TEC. Potentially equivalent to CLW VT 17, which was mapped over 16,372 ha in the Cooljarloo West Study Area and has possibly equivalent/similar vegetation in Moore River National Park, Namming, Bundarra and Wanagarren Nature Reserves, Lancelin Defence Training Area and on Bassendean Sands (including in State Forest and Nature Reserve) (Woodman Environmental, 2014b). 	
D-B	8.3	 Not considered significant in a local context Mapped over many large occurrences in the Study Area. Does not occur on a restricted landform. Not restricted in the Survey Area. 	 Considered significant in a regional context Forms part of the 'Banksia Woodland of the Swan Coastal Plain' TEC. Potentially equivalent to CLW VT 18, which was mapped over 6,344 ha in the Cooljarloo West Study Area and has possibly equivalent/similar vegetation in Moore River National Park, Namming and Wanagarren Nature Reserves, Lancelin Defence Training Area and on Spearwood and Bassendean Sands (including in Crown Land) (Woodman Environmental, 2014b). 	
D-C	0.1	 Considered significant in a local context Mapped in two very small occurrences in the Survey Area. Occurs on a restricted landform (ironstone hill). Restricted extent in the Survey Area. 	 Potentially significant in a regional context No strong similarities to any CLW VTs. Likely to be other occurrences of this VT outside the Survey Area; based on aerial imagery interpretation, at least one patch of potentially equivalent vegetation is present approx. 1.2 km west of the main occurrence of VT D-C, and there is the potential for other patches to be present regionally that are too small to see on aerial imagery. Landform type is likely to be somewhat restricted regionally. 	
W-A	1.3	 Considered significant in a local context Mapped in a small number of small occurrences in the Survey Area. Occurs on a relatively restricted landform (clay pans). Relatively restricted extent in the Survey Area. 	 Potentially significant in a regional context Potentially represents a slightly wetter, more clayey version of CLW VT 2, which was mapped over 1,056 ha in the Cooljarloo West Study Area and has possibly equivalent/similar vegetation in Eneminga Nature Reserve (Woodman Environmental, 2014b). Landform type is likely to be somewhat restricted regionally. 	



VT	% of Survey	Summary of Potential Significance		
	Area	Local Context	Regional Context (with Reference to CLW VTs)	
W-B	1.0	 Not considered significant in a local context Occupies a relatively small area in the Survey Area, but likely an artefact of the Survey Area boundary intersecting a small proportion of this VT on its northeastern boundary; the VT corresponds with Bassendean 2 soil landscape subsystem, which extends slightly into the Survey Area from the northeast. Does not occur on a restricted landform. 	 Not considered significant in a regional context Potentially equivalent to CLW VT 2, which was mapped over 1,056 ha in the Cooljarloo West Study Area and has possibly equivalent/similar vegetation in Eneminga Nature Reserve (Woodman Environmental, 2014b). Landform type is unlikely to be restricted regionally. 	
W-C	45.0	 Not considered significant in a local context Mapped over many large occurrences in the Study Area. Does not occur on a restricted landform. Not restricted in the Survey Area. 	 Not considered significant in a regional context Potentially equivalent to CLW VTs 1 and 5, which were mapped over a total of 6,039 ha in the Cooljarloo West Study Area, and have possibly equivalent/similar vegetation in Moore River and Nambung National Parks and Namming Nature Reserve (Woodman Environmental, 2014b). Landform type is unlikely to be restricted regionally. 	
W-D	3.6	 Not considered significant in a local context Occupies a relatively small area in the Survey Area, but likely an artefact of the Survey Area boundary intersecting a small proportion of this VT in its northwest corner; vegetation patterning clearly extends further north and west. Does not occur on a restricted landform. 	 Not considered significant in a regional context Potentially equivalent to CLW VT 2, which was mapped over 1,056 ha in the Cooljarloo West Study Area and has possibly equivalent/similar vegetation in Eneminga Nature Reserve (Woodman Environmental, 2014b). Landform type is unlikely to be restricted regionally. 	
W-E	1.5	 Not considered significant in a local context Occupies a relatively small area in the Survey Area, but likely an artefact of the Survey Area boundary intersecting a small proportion of this VT. Does not occur on a restricted landform. 	 Not considered significant in a regional context Potentially equivalent to CLW VTs 9a and 9b, which were mapped over a combined 1.6 % of the Cooljarloo West Study Area. CLW VTs 9a and 9b have possibly equivalent/similar vegetation in UCL to north and south, Lancelin Defence Training Area, and on Bassendean Sands (including some areas in Nature Reserves) (Woodman Environmental, 2014b). Landform type is unlikely to be restricted regionally. 	



5.2.7.4 Likelihood of Occurrence of Further Significant Vegetation

As discussed in **Section 5.1.5**, three listed significant vegetation communities were identified as potentially occurring in the Desktop Study Area. Of these, the 'Banksia Woodlands of the Swan Coastal Plain' TEC is considered to occur in the Survey Area (**Section 5.2.7.1**). **Table 5.12** presents an assessment of the potential presence of the remaining two significant vegetation communities in the Survey Area.

In summary, neither of these listed significant vegetation communities are considered to occur in the Survey Area.



 Table 5.12
 Likelihood of Occurrence of Further Significant Vegetation in the Survey Area

EPBC TEC	State TEC/PEC	Description	Nearest Known Location	Comment
Clay pans of the Swan Coastal Plain (CR)	Claypans with mid dense shrublands of Melaleuca lateritia over herbs (P1)	Claypans (predominantly deep basin claypans) usually dominated by a shrubland of <i>Melaleuca lateritia</i> with dense herbs, occurring both on the coastal plain and the adjacent plateau. The clay pans are characterised by taxa that are adapted to presence of surface water such as <i>Hydrocotyle lemnoides</i> (P4), or to a combination of terrestrial and wet phases such as <i>Glossostigma diandrum</i> , <i>Liparophyllum capitatum</i> and <i>Eleocharis keigheryi</i> (T). This community is known from the SCP and Jarrah Forest IBRA regions (DBCA, 2023d; DPaW, 2015). Studies on water relations in a clay pan of this type in Drummond Nature Reserve found that there is little connection between the surface and groundwater systems (Forbes & Vogwill, 2012). This PEC forms a component of the 'Clay pans of the Swan Coastal Plain' EPBC-listed TEC.	24 km south: Bashford Nature Reserve (R 39221), Mimegarra (DPaW, 2015)	Unlikely to be present This TEC corresponds with five separate ecological community types, four of which (SCP07, 08, 09 and 10a) correspond to FCTs on the southern SCP as defined by Gibson et al. (1994), and the fifth being the 'Clay pans with shrubs over herbs' community (117) (DSEWPC, 2012). As discussed in Section 5.2.7.2, the SCP FCTs on the southern SCP that form components of this TEC are not considered to occur in the Survey Area, as the Survey Area is located on the northern SCP, outside the range of the two studies that defined these FCTs. The Survey Area occurs within the known range of Melaleuca lateritia (WA Herbarium, 1998-), and 24 km north of the most northern known occurrence of this PEC (Bashford Nature Reserve). Melaleuca lateritia was recorded at one location in the Survey Area (relevé ROMP01 in VT W-A); however, it was present at low densities at this location, and the vegetation at the location did not represent a 'dense shrubland' of Melaleuca lateritia. Some herbs were present, but there were other strata layers including sedges and low shrubs. The landform was not a deep basin as described by the study in which this PEC was first described (Gibson et al., 2005). Of the 129 taxa that commonly occur in this PEC (Appendix 2 of the Interim Recovery Plan (DPaW, 2015)), only five taxa (Drosera glanduligera, Hypochaeris glabra, Melaleuca teretifolia, Ursinia anthemoides, and Wurmbea dioica) were present in relevé ROMP01, and none of these taxa are restricted only to clay pan communities. The species composition of VT W-A (the only VT in the Survey Area that occurs in true clay pans) did not correlate strongly with that of the PEC. On average, quadrats in VT



EPBC TEC	State TEC/PEC	Description	Nearest Known Location	Comment
				W-A had an average annual taxon richness of 16, and a total cover of annual taxa of 6.7 %. Only 21 taxa of the 129 taxa that commonly occur in this PEC were recorded across all quadrats in VT W-A (Centrolepis aristata, *Cicendia filiformis, Drosera gigantea, Drosera menziesii, Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) (P3), Gonocarpus nodulosus, Goodenia micrantha, Hakea varia, Hyalosperma cotula, Hydrocotyle alata, *Juncus capitatus, Melaleuca viminea, Neurachne alopecuroidea, Philydrella pygmaea, Podolepis gracilis, Siloxerus humifusus, Siloxerus multiflorus, Stylidium calcaratum, Thelymitra vulgaris, Utricularia multifida and Xanthorrhoea preissii). As for relevé ROMP01, many of these taxa are not restricted to clay pan communities or this particular PEC and are therefore not considered to be indicators of the PEC. No aquatic or amphibious taxa were recorded, which are apparently characteristic of the vegetation representative of the PEC (Gibson et al., 2005). In summary, the DBCA PEC (and consequently the EPBC TEC) is considered unlikely to be present in the Survey Area.
Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community (CR)	Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain) (P3)	This community is largely confined to the Perth IBRA subregion of the SCP, extending from Jurien in the north to the Sabina River near Busselton in the south; however, it is most prominent in the southern part of this distribution. The TEC is associated with calcareous soils on the western side of the SCP, including the coast. It largely occurs on sandy, well-drained soils; however, there are occurrences in other areas such as on protected swales, saline and freshwater wetlands, close to riverbanks and on limestone slopes (B. J. Keighery et al., 2002; G. J. Keighery, 2002; Ruthrof	42 km southeast: near the intersection of Sappers and Cowalla Roads (DBCA, 2022b)	Not considered to be present There are no records of this vegetation community in the Desktop Study Area. This TEC/PEC is strongly associated with calcareous soils of the western part of the SCP, including those very close to the coast (DoEE, 2019); soils matching this description were not observed in the Survey Area, and do not correlate with the soil landscape mapping for the Survey Area (Section 2.2). The Approved Conservation Advice for this community (DoEE, 2019) lists key diagnostic criteria that must be met in order for patches of vegetation to be considered part of



EPBC TEC State TEC,	PEC Description	Nearest Known Location	Comment
	et al., 2002). The TEC is primarily located on Spearwood dune systems, but occurs on the Quindalup and Bassandean dune systems to a lesser extent (DoEE, 2019). Tuart is the key upper canopy species although it may co-occur with trees of other species. Trees commonly co-occurring with Tuart include Agonis flexuosa, Banksia grandis, Banksia attenuata, Eucalyptus marginata; and less commonly, Corymbia calophylla, Banksia menziesii and Banksia prionotes. An understorey of native plants is typically present, which may include grasses, herbs and shrubs (DBCA, 2023d; DoEE, 2019). Tuart can occasionally occur as a separate stratum above a woodland dominated by Banksia spp., in which case the patches are more likely to meet the Banksia woodlands TEC diagnostic characteristics. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this PEC.		this TEC. The first criterion states that the patch of vegetation must occur within the SCP IBRA bioregion; therefore, this criterion is met. The second criterion relates to soils and landform. The community primarily occurs on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes, the Pinjarra Plain, and on the banks of rivers and wetlands. The Survey Area occurs on the Bassendean system (Section 2.2), and therefore this criterion is met. The third criterion, and the primary defining feature of the community, relates to the presence and density of Eucalyptus gomphocephala trees. This species was not recorded in the Survey Area, and the Survey Area is located outside the native range of the taxon, which typically occurs closer to the coast (WA Herbarium, 1998-). Therefore, this criterion is not met, and the TEC is not considered to occur.



5.2.8 Groundwater and Surface Water Dependent Vegetation

As per **Section 5.1.6.1**, the entire Survey Area has been mapped by a national (regional) assessment as being 'high' potential terrestrial GDE, and much of the Survey Area as 'high' potential aquatic GDE (BoM, 2023b). Studies on the Northern Sandplains have shown that vegetation may access groundwater at depths less than 10 below ground level (mbgl), and that there is reduced reliance on groundwater by vegetation where depth to groundwater exceeds 10 mbgl (Eamus et al. (2004) in Froend & Loomes (2004); Froend et al. (2011)). There is no depth to groundwater data available for the Survey Area to confirm the presence of groundwater at a depth that is accessible to vegetation. However, bore data is available for bores CS31S and CS31D (Department of Water and Environmental Regulation (DWER) bore ID 61730548 and 61730549, respectively), located just outside the Survey Area, 170 m south of quadrat OLF06, in vegetation contiguous with that mapped as VT D-B. These bores generally show water at a depth of around 3.6 to 5.0 mbgl throughout the year **Table 5.13**. This suggests that there may be parts of the Survey Area where groundwater can be accessed and utilised by vegetation.

Table 5.13 Depth to Groundwater at Bores Relevant to Survey Area

Bore	Easting	Northing	Elevation*	Location	Date	Depth (mbgl)
61730548	344191	6609968	67.98	Just outside Survey Area,	19/03/19	4.41
				170 m south of quadrat OLF06	15/10/19	4.36
					19/05/20	4.75
					13/10/20	4.61
					23/03/21	4.78
					29/03/22	4.48
					26/10/22	3.60
					21/03/23	4.43
					24/10/23	4.39
61730549	344191	6609967	67.98	Just outside Survey Area,	19/03/19	4.57
				170 m south of quadrat OLF06	15/10/19	4.52
					19/05/20	4.89
					13/10/20	4.75
					23/03/21	4.93
					29/03/22	4.65
					26/10/22	3.74
					21/03/23	4.60
					24/10/23	4.54
					19/03/19	4.41
					15/10/19	4.36

Locations are in GDA2020 Zone 50.

Source: DWER Water Information Reporting Database (DWER, 2023).

^{*} Elevation at top of casing, in m Australian Height Datum (AHD).



A number of known phreatophytic taxa are present in the Survey Area. **Table 5.14** presents a summary of the obligate and facultative phreatophytic tree taxa recorded in VTs in the Survey Area, and their frequency in the VTs, as potential indicators of the groundwater dependence of these VTs. In summary:

- No phreatophytic tree taxa were recorded in VT D-C, and given it occurs on rocky ironstone hills, this VT is unlikely to represent GDV. This VT is also unlikely to be particularly surface-water dependent.
- Similarly, no phreatophytic tree taxa were recorded in VT W-B. However, some characteristic taxa of this VT (including *Regelia ciliata* and *Calytrix flavescens*) are potentially facultative phreatophytes (Groom et al., 2000). This VT occurs on sandy loam on seasonally damp undulating plains. The mapped occurrences of this VT generally do not correspond with the potential aquatic GDEs as per the BoM GDE Atlas (2023b). However, it is possible that this VT may have some connection to groundwater and may represent terrestrial GDV, and is also likely surface-water dependent due to its low point in the landscape, resulting in seasonal waterlogging.
- VTs D-A and D-B contain co-dominant facultative phreatophytes (*Banksia attenuata* and *Banksia menziesii*). The vegetation within these VTs may be able to access groundwater where the depth to groundwater is less than 10 mbgl, and therefore potentially represent GDV. These VTs are unlikely to be particularly surface-water dependent.
- Obligate and facultative phreatophytes were recorded at varying frequencies in VTs W-A, W-C, W-D and W-E. The mapped occurrences of these VTs generally correspond with the 'high' potential aquatic GDEs as per the BoM GDE Atlas (2023b). These VTs are therefore likely to represent GDV, and may also have some dependence on surface water flows given they generally represent low points in the landscape (DPIRD, 2019a).

Table 5.14 Phreatophytic Tree Taxa Recorded in VTs in the Survey Area

Туре	Taxon	VT	Frequency
Obligate	Banksia littoralis	W-E	Uncommon
	Melaleuca preissiana	W-A	Uncommon
		W-C	Uncommon
	Melaleuca rhaphiophylla	W-A	Uncommon
		W-C	Uncommon
		W-D	Relatively common
		W-E	Common
Facultative	Banksia attenuata	D-A	Co-dominant
		D-B	Co-dominant
		W-C	Uncommon
	Banksia menziesii	D-A	Co-dominant
		D-B	Co-dominant
		W-C	Uncommon
		W-E	Uncommon
	Eucalyptus rudis subsp. rudis	W-E	Uncommon



5.2.9 Vegetation Condition

Table 5.15 presents the area (ha) of each VT and corresponding condition rating (as per EPA (2016b); **Section 3.4.2**) mapped in the Survey Area by the 2022 survey, and condition boundaries are presented in **Figure 5.8**.

Vegetation condition mapping of assessed VTs was performed for 78.8 % (or 1,040.5 ha) of the Survey Area (i.e. all vegetated areas). Of the mapped area, 97.5 % was rated as being in 'Excellent' condition; these areas had intact vegetation structures, no or little evidence of impact to vegetation composition as a result of human or animal activities, and/or there were only low levels of introduced (weed) taxa (**Table 5.15**; **Figure 5.8**).

The next most common vegetation condition rating was 'Very Good', representing only 2.1 % of the vegetated area of the Survey Area, or 21.7 ha (**Table 5.15**). Areas with this condition rating had slightly higher levels of weed taxa that resulted in obvious (but not significant) signs of alteration to the vegetation structure. This condition rating was mapped in parts of VT W-D in the northern part of the Survey Area, as well as much of the vegetation bordering the large block of farmland in the southern part of the Survey Area (**Figure 5.8**).

A total of 4.7 ha, or 0.5 % of the vegetated area of the Survey Area, was rated as being in 'Good' condition (**Table 5.15**). This category was mapped in the vegetation bordering the farmland block, where weed incursion and grazing was more significant (**Figure 5.8**).

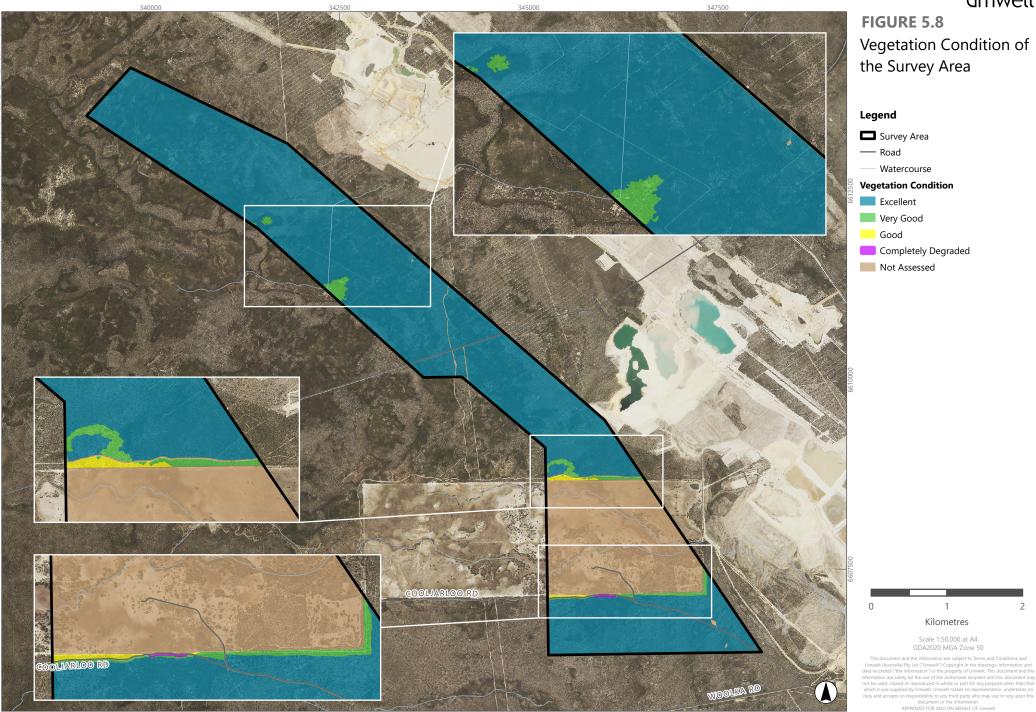
A very small area (0.1 ha or 0.01 %) near the southern border of the farmland block was rated as being 'Completely Degraded' (**Table 5.15**; **Figure 5.8**). This vegetation had been impacted by partial clearing, animal activity and a high density of weeds.

Areas that were mapped as 'Cleared Land', or small patches of vegetation isolated within large occurrences of Cleared Land, were rated as 'Not Assessed' and comprise 1.0 % (or 13.6 ha) of the entire Survey Area. Similarly, the large block of farmland in the southern part of the Survey Area was mapped as 'Not Assessed', representing 20.2 % of the Survey Area (**Figure 5.8**).

Table 5.15 Vegetation Condition Ratings for VTs Mapped in the Survey Area

VT	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
D-A	232.7	5.2	0.8	-	-	238.8
D-B	106.6	2.3	0.03	-	-	108.9
D-C	0.8	-	-	-	-	0.8
W-A	9.7	4.0	2.9	-	-	16.6
W-B	13.5	-	-	-	-	13.5
W-C	591.5	2.1	0.9	-	0.01	594.5
W-D	39.2	8.1	0.1	-	0.1	47.4
W-E	19.9	-	-	-	-	19.9
Total	1,014.0	21.7	4.7	-	0.1	1,040.5







6.0 Discussion and Conclusions

The Survey Area is considered to have high diversity in terms of taxon richness, with 406 discrete vascular flora taxa recorded by the 2022 and Cooljarloo West surveys recorded in the Survey Area. This was generally expected given its topographical and geological features present, as well as its location in the Geraldton Sandplains region, which is known to have a high diversity of both flora taxa and vegetation types, as well as a moderately level of endemism.

Similar to the flora, the diversity of VTs within the Survey Area is considered to be moderately high, due to the Survey Area intersecting an area of relatively high topographic and soil type diversity. However, vegetation types that are known from the vicinity, including saline clay pans and true lateritic areas recorded by the Cooljarloo West assessment, were not present in the Survey Area.

A total of 55 significant flora taxa have been recorded in the Survey Area via various previous assessments, 14 of which were recorded by the 2022 survey. This includes two significant flora taxa recorded in the Survey Area for the first time by the 2022 survey, *Hypocalymma quadrangulare* (P3) and *Poranthera asybosca* (P1); however, these taxa have previous known records in close proximity to the Survey Area. According to the WA Herbarium database, *Poranthera asybosca* (P1) only known from two locations. However, Umwelt have made collections of this taxon in Arrowsmith near Yardanogo Nature Reserve, south to Cooljarloo, extending the known range of the taxon from 100 km to approximately 150 km. Representative specimens and TPFRFs have been supplied to the WA Herbarium and DBCA, respectively; however, these records have not yet been uploaded to Florabase.

Potential preferred habitat has been identified for the 14 significant flora taxa recorded in the Survey Area. However, given this current assessment was a Detailed survey and as such significant flora taxa were recorded opportunistically, there may not be sufficient data to confidently assign preferred habitat for these taxa. Targeted survey was undertaken in the Osprey disturbance footprint in Spring 2023; the dataset from that assessment can be considered a more complete representation of significant flora populations and abundance at Osprey, and from that, their preferred habitat within the Survey Area can be more confidently determined (subject to a separate report).

A likelihood of occurrence assessment was undertaken for the 80 significant flora taxa identified by the desktop assessment but not recorded by the 2022 survey. This assessment determined that one taxon, *Myriophyllum muelleri* (P1), would theoretically not be identifiable at the time of the 2022 survey; this taxon is an annual species that is known from only two records, one from the beginning and the other from the end of November (WA Herbarium, 1998-). It is possible that the second site visit may have captured the emergent period of this taxon, but with so little data available for the taxon, this cannot be determined conclusively. Nevertheless, *Myriophyllum muelleri* (P1) is considered unlikely to occur in the Survey Area, as habitat is not considered to be present (inundated winter-wet depressions, freshwater lagoons). The remaining 79 significant flora taxa were considered likely to be identifiable during the 2022 survey, either because the survey period coincides with the taxon's flowering period, or the taxon can be identified reliably when in fruit or sterile. Of these, 16 taxa were considered to possibly still occur in the Survey Area as suitable habitat is potentially present, and the Survey Area is within (or in close proximity to) the taxa's known ranges.

Collections of six flora taxa made during the 2022 survey represent range extensions or fill gaps within these taxon's known distributions. These taxa include *Cassytha glabella* forma *glabella*, the collection of



which represents a range extension of approximately 235 km. This taxon is known from a wide distribution, with the northern-most known records occurring north of Geraldton, the eastern-most near Coolgardie, and the southern-most at Hopetoun (WA Herbarium, 1998-). It is likely that surveyors have inadvertently overlooked this particular form, as *Cassytha glabella* is very common in South West WA, or adequate material has not been available to confidently identify the taxon to subspecies level (as this requires good quality flowering and fruiting material).

A total of eight VTs were defined and mapped based on the results of two floristic classification analyses; one analysis containing the 2022 quadrat data only, and the second containing data from quadrats established in 2022 and additional quadrats from the Cooljarloo West assessment. VTs D-A and D-B are considered representative of the 'Banksia Woodland of the Swan Coastal Plain' EPBC TEC/DBCA PEC, and are consequently considered significant in a regional context. An additional two VTs (VTs D-C and W-A) are considered potentially significant in a local and regional context for reasons other than formal listing, due to occurring on restricted landform types and/or having relatively restricted extents in the Survey Area.

Obligate and facultative phreatophytes were recorded at varying frequencies in VTs W-A, W-C, W-D and W-E; these VTs are therefore likely to represent GDV, as well as likely having some dependence on surface water flows. VTs D-A and D-B contain co-dominant facultative phreatophytes, and consequently these VTs potentially represent GDV where the depth to groundwater is less than 10 mbgl. No phreatophytic tree taxa were recorded in VT W-B, but some phreatophytic shrub taxa are common in the VT; therefore, while this VT may be seasonally wet and surface-water dependent, it is also potentially representative of terrestrial GDV. However, data presenting the depth to groundwater across the Survey Area would assist to clarifying the potential groundwater dependence of the vegetation.

The majority of the vegetation in the Survey Area was rated and mapped as being in 'Excellent' condition, with intact vegetation structures, no or little evidence of impact to vegetation composition as a result of human or animal activities, and/or only low levels of introduced (weed) taxa. The mapped areas of 'Very Good' or lower generally corresponded to the vegetation bordering the farmland block, where edge effects, weed incursion, grazing and partial clearing were more significant.

There were no survey limitations that are considered to have significantly influenced the results of the current survey. Personnel involved in all aspects of the survey have significant previous experience and guided less experienced personnel throughout the survey where necessary. Reasonable contextual information for the Survey Area was available prior to the 2022 field survey. No constraints prevented appropriate sampling techniques (quadrat/relevé establishment, foot traverses) being employed. Most areas were relatively easy to access using available access tracks and drill lines. Data reliability is therefore considered to be relatively high. All vascular groups that were present in the Survey Area were sampled, and at least one reference specimen of all taxa encountered (excluding common, distinctive taxa) was collected for verification and identification purposes. Precipitation received in the three months prior to the 2022 field survey was above average, and the field assessment was conducted within what is generally considered to be the ideal time to survey in the SCP Bioregion (September to November). Adequacy of survey measures indicate that the Survey Area was well sampled.



7.0 References

360 Environmental. (2012). *Atlas Tenement Level 2 Flora and Vegetation Survey – North Perth Mineral Sands Project (Single Phase)* (Report (EBS133 AD, Rev B, 13 February 2012) prepared for Image Resources NL; p. 172). 360 Environmental Pty Limited (360 Environmental).

360 Environmental. (2017a). Second Phase Flora and Vegetation Survey: EP 447 R1 – North Perth Basin, Walyering (Memo report (1845AC, 23 May 2017) to John Begg, Chairman, Bombora Natural Energy; p. 20). 360 Environmental Pty Limited (360 Environmental).

360 Environmental. (2017b). *Threatened & Priority Flora and Vegetation Report: EP 447 R1* (Report (1845 AB, Rev C Final, 10 February 2017) prepared for Bombora Natural Energy; p. 107). 360 Environmental Pty Limited (360 Environmental).

ALA. (2023). *Atlas of Living Australia – Open access to Australia's biodiversity data*. Atlas of Living Australia (ALA). https://www.ala.org.au/

Astron. (2012). *Targeted Flora Search of Additional Exploration Access Lines Cooljarloo West* (Report (16504-12-BSR-2Rev0_130507) prepared for Tronox Management Pty Limited; p. 46). Astron Environmental Services Pty Limited (Astron).

Astron. (2013). *Botanical Survey of 2013 Exploration Access Lines Cooljarloo* (Report (16502b-12-BSR-1Rev1_130205) prepared for Tronox Management Pty Ltd; p. 110). Astron Environmental Services Pty Ltd (Astron).

Barrett, R. L., & Barrett, M. D. (2015). Twenty-seven new species of vascular plants from Western Australia. *Nuytsia*, *26*, 21–87. https://doi.org/10.58828/nuy00730

Beard, J. S. (2015). *Plant Life of Western Australia* (A. S. George & N. Gibson, Eds.; 2nd ed.). Rosenberg Publishing. Kenthurst, New South Wales.

Beard, J. S., Beeston, G. R., Harvey, J. M., Hopkins, A. J. M., & Shepherd, D. P. (2013). The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second Edition. *Conservation Science Western Australia*, *9*(3), 1–152.

BoM. (2023a). *Bureau of Meteorology Climate Data Online*. Commonwealth of Australia, Bureau of Meteorology (BoM). http://www.bom.gov.au/climate/data/

BoM. (2023b). *Groundwater Dependent Ecosystems Atlas*. Commonwealth of Australia, Bureau of Meteorology (BoM). http://www.bom.gov.au/water/groundwater/gde

Brown, K., & Brooks, K. (2002). Bushland Weeds: A practical guide to their management with case studies from the Swan Coastal Plain and beyond. Environmental Weeds Action Network (Inc). https://www.dbca.wa.gov.au/parks-and-wildlife-service/threat-management/plant-diseases/weeds

Chao, A. (1987). Estimating the population size for capture-recapture data with unequal catchability. *Biometrics*, 43(4), 783–791.



Chao, A., Ma, K. H., Hsieh, T. C., & Chiu, C.-H. (2016). *SpadeR: Species-Richness Prediction and Diversity Estimation with R* (0.1.1). https://CRAN.R-project.org/package=SpadeR

DAWE. (2013). *Draft survey guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed as 'Threatened' under the* Environment Protection and Biodiversity Conservation Act 1999 (p. 85). Department of Agriculture, Water and Environment (DAWE), Commonwealth of Australia. http://www.environment.gov.au/resource/draft-survey-guidelines-australias-threatened-orchids

DAWE. (2019). *Australian Wetlands Database—Directory of Important Wetlands*. Last Updated 14 June 2019. Department of Agriculture, Water and Environment (DAWE). https://www.environment.gov.au/cgibin/wetlands/search.pl?smode=DOIW

DAWE. (2021). *Protected Matters Search Tool: Interactive Map*. Interrogation of Species Profile and Threats (SPRAT) Database Using Protected Matters Search Tool. Department of Agriculture, Water and the Environment (DAWE). https://www.environment.gov.au/epbc/protected-matters-search-tool

DAWE. (2022). *Protected Matters Search Tool: Interactive Map.* Interrogation of Species Profile and Threats (SPRAT) Database Using Protected Matters Search Tool. Department of Agriculture, Water and the Environment (DAWE). https://www.environment.gov.au/epbc/protected-matters-search-tool

DBCA. (2014). Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife Midwest Region Species Prioritisation Process 2014. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/parks-and-wildlife-service/threat-management/plant-diseases/weeds

DBCA. (2017a). A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia (Draft report prepared by the Wetlands Section, Department of Biodiversity, Conservation and Attractions (DBCA) & the Urban Water Branch, Department of Water and Environmental Regulation (DWER). Perth, Western Australia; p. 81). https://www.dpaw.wa.gov.au/management/wetlands/mapping-and-monitoring

DBCA. (2017b). *Geomorphic Wetlands Cervantes Eneabba (DBCA-015)*. Spatial data. Last updated 13 September 2017. Department of Biodiversity, Conservation and Attractions (DBCA). https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-cervantes-eneabba

DBCA. (2018). *Directory of Important Wetlands in Australia—Western Australia (DBCA-045)*. Spatial data. Last updated 27 April 2018. Department of Biodiversity, Conservation and Attractions (DBCA). https://catalogue.data.wa.gov.au/dataset/directory-of-important-wetlands-in-western-australia

DBCA. (2019). 2018 Statewide Vegetation Statistics (formerly the CAR Reserve Analysis): Full Report. Last updated 30 April 2019. Remote Sensing and Spatial Analysis Program, Department of Biodiversity, Conservation and Attractions (DBCA). https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

DBCA. (2021a). *DBCA Threatened and Priority Ecological Communities Database*. Database interrogation. Performed 28 September 2021, reference 56-0921EC. Department of Biodiversity, Conservation and Attractions (DBCA).



DBCA. (2021b). *DBCA WA Herbarium Specimen and Threatened and Priority Flora (TPFL) Databases*. Database interrogation. Performed 30 September 2021, reference 86-0921FL. Department of Biodiversity, Conservation and Attractions (DBCA).

DBCA. (2022a). *NatureMap: DBCA WA Herbarium Specimen and Threatened and Priority Flora (TPFL) Databases*. Database interrogation, requested by email. Department of Biodiversity, Conservation and Attractions (DBCA).

DBCA. (2022b). *Threatened Ecological Communities (DBCA-038)*. Spatial data. Last updated 8 December 2022. Department of Biodiversity, Conservation and Attractions (DBCA). https://catalogue.data.wa.gov.au/dataset/threatened-ecological-communities

DBCA. (2023a). Conservation Category Definitions for Western Australian Ecological Communities. 21 August 2023. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/management/threatened-species-and-communities/nominations-listing

DBCA. (2023b). Conservation Category Definitions for Western Australian Flora and Fauna. 8 August 2023. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/management/threatened-species-and-communities/nominations-listing

DBCA. (2023c). *Methods for survey and identification of Western Australian threatened ecological communities* (Draft version 4.0, 30 January 2023). Department of Biodiversity, Conservation and Attractions (DBCA), Species and Communities Program. https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities

DBCA. (2023d). *Priority Ecological Communities for Western Australia Version 35*. Species and Communities Program, 19 June 2023. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities

DBCA. (2023e). *Threatened and Priority Flora List 1 December 2023*. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/wildlife-and-ecosystems/plants/list-threatened-and-priority-flora

DBCA. (2023f). Threatened Ecological Communities (TECs) Listed under the Biodiversity Conservation Act 2016. Species and Communities Branch, 28 November 2023. Department of Biodiversity, Conservation and Attractions (DBCA). https://www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities/list-threatened-ecological-communities

DBCA. (2007-2021). *NatureMap: Mapping Western Australia's Biodiversity*. Threatened and Priority Flora and WA Herbarium Specimen Databases. Department of Biodiversity, Conservation and Attractions (DBCA). https://naturemap.dbca.wa.gov.au/

DCCEEW. (2023a). *Australia's Bioregions (IBRA)*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). https://www.dcceew.gov.au/environment/land/nrs/science/ibra

DCCEEW. (2023b). *Interim Biogeographic Regionalisation for Australia (IBRA) Version 7 (Regions)*. Spatial data. Last updated 17 October 2023. Department of Climate Change, Energy, the Environment and Water (DCCEEW). https://fed.dcceew.gov.au/datasets/interim-biogeographic-regionalisation-for-australia-ibra-version-7-regions/explore



DCCEEW. (2023c). *Species Profile and Threats Database*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

DEC. (2011). *Project summary: Geomorphic Wetlands Cervantes Eneabba Stage 1 project* (p. 7). Department of Environment and Conservation (DEC). https://www.dpaw.wa.gov.au/management/wetlands/mapping-and-monitoring/220-wetlands-mapping?showall=1

Desmond, A., & Chant, A. (2002). *Geraldton Sandplain 3 (GS3—Lesueur Sandplain subregion)* (A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, p. 21). Department of Conservation and Land Management. https://www.dpaw.wa.gov.au/about-us/science-and-research/biological-surveys/117-a-biodiversity-audit-of-wa

DEWHA. (2008). Approved conservation advice for Ptychosema pusillum (Dwarf Pea) (p. 3). Department of the Environment, Water, Heritage and the Arts (DEWHA). Canberra, Australian Capital Territory. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=11268

Dodd, J., & Bell, D. T. (1993). Water relations of the canopy species in a Banksia woodland, Swan Coastal Plain, Western Australia. *Australian Journal of Ecology*, *18*(3), 281–293. https://doi.org/10.1111/j.1442-9993.1993.tb00456.x

DoEE. (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (p. 143). Department of the Environment and Energy (DoEE). Canberra, Australian Capital Territory. https://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=131

DoEE. (2019). Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community (p. 158). Department of the Environment and Energy (DoEE). Canberra, Australian Capital Territory. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=153

Doody, T. M., Barron, O. V., Dowsley, K., Emelyanova, I., Fawcett, J., Overton, I. C., Pritchard, J. L., Van Dijk, A. I. J. M., & Warren, G. (2017). Continental mapping of groundwater dependent ecosystems: A methodological framework to integrate diverse data and expert opinion. *Journal of Hydrology: Regional Studies*, 10, 61–81. https://doi.org/10.1016/j.ejrh.2017.01.003

DPaW. (2015). Interim Recovery Plan 2015-2020 for Clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of Melaleuca lateritia over herbs (Interim Recovery Plan No. 354, p. 80). Department of Parks and Wildlife (DPaW). Kensington, Western Australia. https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities

DPIRD. (2019a). 2 metre contours (DPIRD-072). Spatial data. Last updated 4 April 2019. Department of Primary Industries and Regional Development (DPIRD). https://catalogue.data.wa.gov.au/dataset/dpird-2-metre-contours

DPIRD. (2019b). *Pre-European Vegetation (DPIRD-006)*. Spatial data. Last updated 23 July 2019. Department of Primary Industries and Regional Development (DPIRD). https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006



DPIRD. (2022a). *Soil Landscape Land Quality—Zones (DPIRD-017)*. Spatial data. Last updated 18 July 2022. Department of Primary Industries and Regional Development (DPIRD). https://catalogue.data.wa.gov.au/dataset/soil-landscape-land-quality-zones

DPIRD. (2022b). *Soil Landscape Mapping—Best Available (DPIRD-027)*. Spatial data. Last updated 13 July 2022. Department of Primary Industries and Regional Development (DPIRD). https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available

DSEWPC. (2012). Approved Conservation Advice for Clay Pans of the Swan Coastal Plain (p. 7). Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). Canberra, Australian Capital Territory.

Dufrêne, M., & Legendre, P. (1997). Species Assemblages and Indicator Species: The Need for a Flexible Asymmetrical Approach. *Ecological Monographs*, *67*(3), 345–366. https://doi.org/10.1890/0012-9615(1997)067[0345:SAAIST]2.0.CO;2

DWER. (2022). *Index of Biodiversity Surveys for Assessments (IBSA)*. Department of Water and Environmental Regulation (DWER). https://biocollect.ala.org.au/ibsa/

DWER. (2023). *Water Information Reporting* [Department of Water and Environmental Regulation (DWER)]. https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx

EPA. (2016a). *Environmental Factor Guideline—Flora and Vegetation* (p. 6). December 2016. Environmental Protection Authority (EPA). https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-flora-and-vegetation

EPA. (2016b). *Technical Guidance—Flora and Vegetation Surveys for Environmental Impact Assessment* (p. 42). December 2016. Environmental Protection Authority (EPA). https://www.epa.wa.gov.au/policies-guidance/technical-guidance-flora-and-vegetation-surveys-environmental-impact-assessment

ESCAVI. (2003). Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0. Executive Steering Committee for Australian Vegetation Information (ESCAVI). Department of the Environment and Heritage. Canberra, Australian Capital Territory.

Forbes, M., & Vogwill, R. (2012). A geochemical investigation of hydrologically derived threats to rare biota: The Drummond Nature Reserve, Western Australia. *Hydrogeology Journal*, *20*(1), 167–183. https://doi.org/10.1007/s10040-011-0780-8

Froend, R., Boyd, T., & Scott, P. (2011). *Tiwest Dongara Mineral Sands Project Groundwater Dependent Ecosystem Impact Assessment* (Report prepared for Tiwest Pty Ltd). Froend, Bowen and Associates and Preston Consulting.

Froend, R., & Loomes, R. (2004). Approach to determination of Ecological Water Requirements of groundwater-dependent ecosystems in Western Australia (Report (CEM2004-12) prepared for the Department of Environment). Centre for Ecosystem Management, Edith Cowan University.

Froend, R., & Loomes, R. (2006). *Determination of ecological water requirements for groundwater-dependent ecosystems – southern Blackwood and eastern Scott Coastal Plain* (Report (CEM2005-07)



prepared for the Department of Water; p. 147). Centre for Ecosystem Management, Edith Cowan University.

Galili, T. (2015). dendextend: An R package for visualizing, adjusting, and comparing trees of hierarchical clustering. *Bioinformatics*. https://doi.org/10.1093/bioinformatics/btv428

Gibson, N., Keighery, B. J., Keighery, G. J., Burbidge, A. H., & Lyons, M. N. (1994). *A floristic survey of the Southern Swan Coastal Plain* (Report prepared for the Australian Heritage Commission). Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Gibson, N., Keighery, G. J., Lyons, M. N., & Keighery, B. J. (2005). Threatened plant communities of Western Australia. 2 The seasonal clay-based wetland communities of the South West. *Pacific Conservation Biology*, 11(4), 287–301. https://doi.org/10.1071/pc050287

Government of Western Australia. (2000). *Bush Forever: Vol. 2: Directory of Bush Forever Sites*. Department of Environmental Protection. Perth, Western Australia. https://www.wa.gov.au/government/publications/bush-forever-policy

Groom, P. K., Froend, R. H., & Mattiske, E. M. (2000). Impact of groundwater abstraction on a Banksia woodland, Swan Coastal Plain, Western Australia. *Ecological Management and Restoration*, 1(2), 117–124. https://doi.org/10.1046/j.1442-8903.2000.00033.x

Hussey, B. M. J., Keighery, G. J., Dodd, J., Lloyd, S. G., & Cousens, R. D. (2007). Western Weeds: A Guide to the Weeds of Western Australia (2nd ed.). Wildflower Society of WA (Inc.). Victoria Park, Western Australia.

Iluka. (2021). *Tronox-Iluka Significant Flora Database*. Provided by Ben Kraft, Senior Environmental Advisor, 16 June 2021. Iluka Resources Limited (Iluka).

Kassambara, A., & Mundt, F. (2020). factoextra: Extract and Visualize the Results of Multivariate Data Analyses (1.0.7). https://CRAN.R-project.org/package=factoextra

Keighery, B. J., Keighery, G. J., Longman, V. M., & Clarke, K. A. (2012). *Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset*. Department of Environment and Conservation. Kensington, Western Australia.

Keighery, B. J., Keighery, G. J., & Shepherd, D. (2002). The Distribution and Conservation of Tuart and the Community with which it Lives. In B. J. Keighery & V. M. Longman (Eds.), *Tuart (Eucalyptus gomphocephala)* and *Tuart Communities* (pp. 6–86). Wildflower Society of Western Australia, Perth Branch. Nedlands, Western Australia.

Keighery, G. J. (2002). The Flora of Tuart Woodlands. In B. J. Keighery & V. M. Longman (Eds.), *Tuart* (Eucalyptus gomphocephala) and *Tuart Communities* (pp. 147–179). Wildflower Society of Western Australia, Perth Branch. Nedlands, Western Australia.

Kolde, R. (2019). pheatmap: Pretty Heatmaps (1.0.12). https://CRAN.R-project.org/package=pheatmap

Landgate. (2022). *Medium Scale Topo Water (Line) (LGATE-018)*. Spatial data. Last updated 31 December 2022. Western Australian Land Information Authority. https://catalogue.data.wa.gov.au/dataset/medium-scale-topo-water-line-lgate-018



Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M., & Hornik, K. (2022). *cluster: Cluster Analysis Basics and Extensions* (2.1.4). https://CRAN.R-project.org/package=cluster

Markey, A. S., & Dillon, S. J. (2006). Flora and Vegetation of the Banded Ironstone Formations of the Yilgarn Craton: The Central Tallering Land System (Unpublished report (draft) prepared for the Department of Environment and Conservation).

Mattiske. (2012). Flora Assessment of Drill Lines in Cooljarloo West, Cooljarloo North West and Cooljarloo South West (Report (TJV1102/085/11, V3) prepared for Tiwest Joint Venture; p. 120). Mattiske Consulting Pty Ltd (Mattiske).

Mattiske. (2017). Conservation Significant Flora Survey and Impact Assessment, Tronox Cooljarloo West Project (Report (TJV1601/023/16, V4) prepared for Tronox Management Pty Ltd; p. 61). Mattiske Consulting Pty Ltd (Mattiske).

Mitchell, D., Williams, K., & Desmond, A. (2002). *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* (A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, p. 18). Department of Conservation and Land Management. https://www.dpaw.wa.gov.au/about-us/science-and-research/biological-surveys/117-a-biodiversity-audit-of-wa

Mueller-Dombois, D., & Ellenberg, H. (1974). *Aims and Methods of Vegetation Ecology*. John Wiley & Sons, Ltd.

Oksanen, J., Simpson, G. L., Blanchet, F. G., Kindt, R., Legendre, P., Minchin, P. R., O'Hara, R. B., Solymos, P., Stevens, M. H. H., Szoecs, E., Wagner, H., Barbour, M., Bedward, M., Bolker, B., Borcard, D., Carvalho, G., Chirico, M., Caceres, M. D., Durand, S., ... Weedon, J. (2022). *vegan: Community Ecology Package* (2.6-4). https://CRAN.R-project.org/package=vegan

Outback Ecology. (2014). Waddi Wind Farm Spring Flora and Vegetation Survey and Black Cockatoo Habitat Survey (Report (WADD-VO-13001, Final report 3, 28 April 2014) prepared for RPS Australia Asia Pacific; p. 122). Outback Ecology (MWH Australia Pty Limited).

R Core Team. (2023). *R: A language and environment for statistical computing* (4.3.1). R Foundation for Statistical Computing. Vienna, Austria. Available: https://www.R-project.org

Roberts, D. W. (2019). *labdsv: Ordination and Multivariate Analysis for Ecology* (2.0-1). https://CRAN.R-project.org/package=labdsv

Ruthrof, K., Yates, C., & Loneragan, W. (2002). The Biology of Tuart. In B. J. Keighery & V. M. Longman (Eds.), *Tuart* (Eucalyptus gomphocephala) and *Tuart Communities* (pp. 108–122). Wildflower Society of Western Australia, Perth Branch. Nedlands, Western Australia.

Rye, B. L. (2015). A revision of the south-western Australian genus *Babingtonia* (Myrtaceae: Chamelaucieae). *Nuytsia*, *25*, 219–250.

Schoknecht, N. R., Tille, P. J., & Purdie, B. R. (2004). *Soil-landscape mapping in south-Western Australia: An overview of methodology and outputs* (No. 280; Resource Management Technical Report, p. 62). Department of Agriculture and Food.



Sommer, B., & Froend, R. (2010). *Gnangara Mound Ecohydrological Study (RFT 0037-2008)* (Report (CEM2010-20) prepared for the Western Australian Government Department of Water; p. 105). Centre for Ecosystem Management, Edith Cowan University.

Strategen. (2020). *Raven 2D Seismic Surveys Ecological Assessment* (Report (JBS&G57624-126824, Rev 0, 21 April 2020) prepared for Energy Resources Limited; p. 66). JBS&G Australia Pty Ltd T/A Strategen-JBS&G (Strategen).

Thiele, K. R. (2013). *Hibbertia sericosepala* (Dilleniaceae), a new species from Western Australia. *Nuytsia*, 23, 479–482.

Tronox. (2022). *Cooljarloo Monthly Rainfall Data 1990-2021*. Tronox Management Pty Limited (Tronox). Provided by Sarah Broomfield, Senior Environmental Rehabilitation Specialist, March 2022.

Tronox. (2023). *Tronox Cooljarloo Weather Data 2014-2022*. Tronox Holdings plc (Tronox). Provided by Sarah Broomfield, Senior Environmental Rehabilitation Specialist, May 2023.

TSSC. (2012). Commonwealth Listing Advice on Claypans of the Swan Coastal Plain (p. 23). Threatened Species Scientific Committee (TSSC), Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australian Capital Territory. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=121

TSSC. (2017). Guidelines for nominating and assessing the eligibility for listing of ecological communities as threatened according to the Environment Protection and Biodiversity Conservation Act 1999 and the EPBC Regulations 2000. Threatened Species Scientific Committee (TSSC), Department of Agriculture, Water and the Environment. Canberra, Australian Capital Territory.

https://www.dcceew.gov.au/environment/biodiversity/threatened/nominations/forms-and-guidelines#threatened-species

TSSC. (2021). Guidelines for assessing the conservation status of native species according to the Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000. Threatened Species Scientific Committee (TSSC), Department of Agriculture, Water and the Environment. Canberra, Australian Capital Territory. https://www.dcceew.gov.au/environment/biodiversity/threatened/nominations/forms-and-guidelines#threatened-species

Umwelt. (2022a). 2020 Rehabilitation Reference Plot Monitoring: Northern Operations—Cooljarloo (Report (Tronox20-53-02, Rev 0) prepared for Tronox Management Pty Limited; p. 176). Umwelt (Australia) Pty Limited (Umwelt).

Umwelt. (2022b). Cooljarloo Exploration Area Exploration Environmental Assessment 2022: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Report (21580/R04, FINAL V2) prepared for Tronox Management Pty Ltd). Umwelt (Australia) Pty Ltd (Umwelt).

Umwelt. (2022c). Flora and Vegetation Gap Analysis and Survey Design: Falcon West Project (Report (21802/R01, Final, 22 February 2022) prepared for Tronox Management plc; p. 140). Umwelt (Australia) Pty Limited (Umwelt).



Umwelt. (2023). Cooljarloo Exploration Area Exploration Environmental Assessment 2023: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Report (22787/R04, FINAL V2) prepared for Tronox Holdings plc; p. 179). Umwelt (Australia) Pty Ltd (Umwelt).

WA Herbarium. (2020). *How to Collect Herbarium Vascular Plant Specimens* (p. 11). Department of Biodiversity, Conservation and Attractions. Western Australian Herbarium (WA Herbarium). https://www.dpaw.wa.gov.au/plants-and-animals/wa-herbarium

WA Herbarium. (1998-). *Florabase: The Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. Western Australian Herbarium (WA Herbarium). https://florabase.dpaw.wa.gov.au/

Woodman Environmental. (2011). *Northern Operations Cooljarloo: Assessment of the Impacts of Mulch Harvesting on Floristic Composition of Native Vegetation* (Report (Tiwest10-35-01, Rev 0) prepared for Tiwest Pty Ltd; p. 337). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2013). *Cooljarloo North Mine: Search of Mine Path for Conservation Significant Flora* (Report (Tronox13-40-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 9). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2014a). *Botanical Survey of 2014/2015 Cooljarloo Drill and Access Lines* (Report (Tronox13-38-03, Rev 3) prepared for Tronox Management Pty Ltd; p. 57). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2014b). *Cooljarloo West Titanium Minerals Project Flora and Vegetation Assessment* (Report (Tronox12-37-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 941). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2015a). *Botanical Survey of 2015 Cooljarloo Drill and Access Lines* (Report (Tronox14-32-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 188). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2015b). *Cooljarloo North Mine: Mine Path Threatened Flora Survey* (Report (Tronox14-50-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 22). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2016). *Exploration Environmental Assessment 2016: Desktop Review, Field Survey and Impact Assessment* (Report (Tronox15-19-02, Rev 0) prepared for Tronox Management Pty Ltd; p. 97). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2017a). Cooljarloo Exploration Area Exploration Environmental Assessment 2017: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Report (Tronox16-16-02, Rev 0) prepared for Tronox Management Pty Ltd; p. 116). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2017b). *Cooljarloo Exploration Area Exploration Environmental Assessment 2017: Desktop Review and Risk Assessment, Field Survey and Impact Assessment* (Report (Tronox16-16-02, Rev 0) prepared for Tronox Management Pty Ltd; p. 116). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).



Woodman Environmental. (2017c). *Cooljarloo Mineral Sands Mine: Survey of Vegetation Polygons for Threatened Flora Taxa* (Report (Tronox17-56-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 7). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

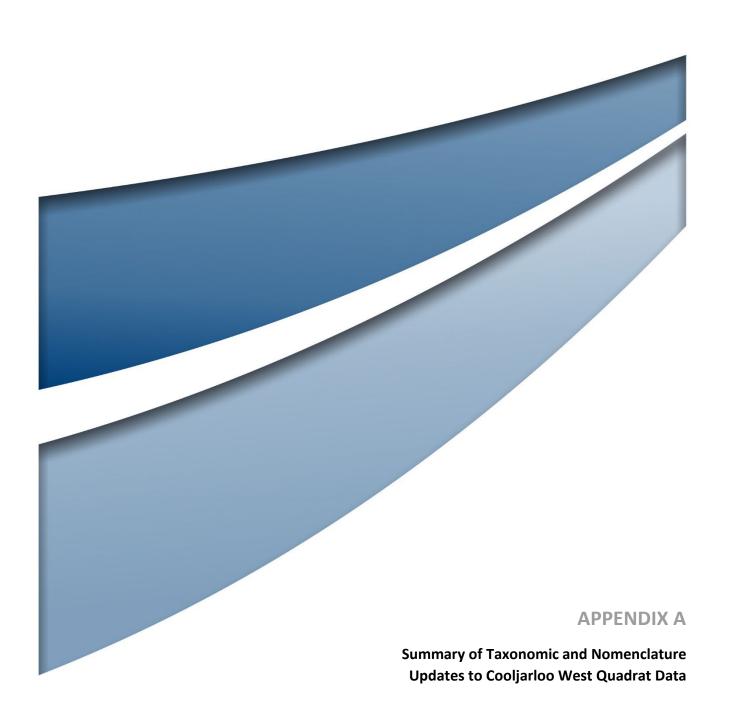
Woodman Environmental. (2018a). *Brand Highway Passing Lanes Survey for Listed Threatened and Priority Flora Taxa* (Report (MR17-57-01, Rev 0) prepared for Main Roads WA; p. 27). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2018b). *Cooljarloo Exploration Area Exploration Environmental Assessment 2018: Desktop Review and Risk Assessment, Field Survey and Impact Assessment* (Report (Tronox17-37-02, Rev 0) prepared for Tronox Management Pty Ltd; p. 136). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2018c). Further Survey for Significant Flora Taxa: Cooljarloo Area, Including Meadows Road Fire Area (Report (Tronox17-45-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 66). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2019). Cooljarloo Exploration Area Exploration Environmental Assessment 2019: Desktop Review and Risk Assessment, Field Survey and Impact Assessment (Report (Tronox18-64-01, Rev 0) prepared for Tronox Management Pty Ltd; p. 231). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).

Woodman Environmental. (2021). *Cooljarloo Exploration Area Exploration Environmental Assessment 2021: Desktop Review and Risk Assessment, Field Survey and Impact Assessment* (Report (Tronox20-56-03, Rev 0) prepared for Tronox Management Pty Ltd; p. 136). Woodman Environmental Consulting Pty Ltd (Woodman Environmental).





Note: **Table A.1** includes updates made to native taxa only.

Table A.1 Taxonomic and Nomenclature Updates Made to Cooljarloo West Quadrat Data

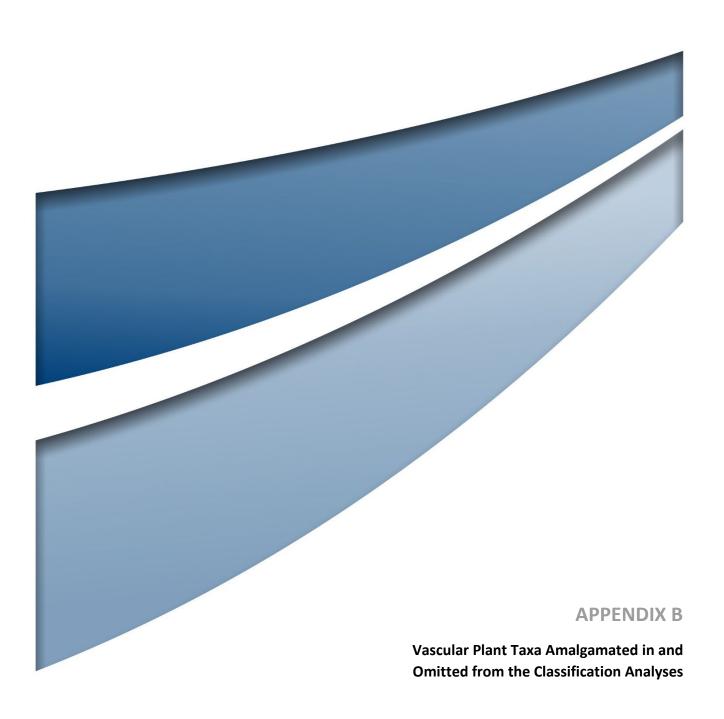
Name in Cooljarloo West Dataset	Updated Name	Reasoning
Acacia saligna subsp. lindleyi ms	Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602)	Nomenclature update
Astroloma glaucescens	Styphelia tortifolia	Nomenclature update
Astroloma microdonta	Styphelia microdonta	Nomenclature update
Astroloma xerophyllum	Styphelia xerophylla	Nomenclature update
Baeckea grandiflora	Babingtonia grandiflora	Nomenclature update
Baeckea sp. Perth Region (R.J. Cranfield 444)	Babingtonia urbana	Nomenclature update
Baumea juncea	Machaerina juncea	Nomenclature update
Boronia ramosa subsp. anethifolia	Cyanothamnus ramosus subsp. anethifolius	Nomenclature update
Boronia subsessilis	Cyanothamnus subsessilis	Nomenclature update
Chordifex chaunocoleus	Chordifex reseminans	According to Florabase, this taxon is restricted to the Toodyay/Bakers Hill area. Very likely to have been historically mis-identified, as other specimens previously identified as this taxon from the Cooljarloo area have been reidentified as Chordifex reseminans (P2)
Conostylis crassinervia Conostylis crassinervia subsp. absens Conostylis crassinervia subsp. crassinervia	Conostylis crassinerva Conostylis crassinerva subsp. absens Conostylis crassinerva subsp. crassinerva	Conostylis crassinervia is incorrectly spelt
Corynotheca micrantha var. elongata	Corynotheca elongata	Nomenclature update
Corynotheca micrantha var. micrantha	Corynotheca micrantha	Nomenclature update
Croninia kingiana	Styphelia kingiana	Nomenclature update
Drosera erythrorhiza subsp. magna	Drosera magna	Nomenclature update
Drosera macrantha subsp. macrantha	Drosera macrantha	Nomenclature update
Drosera menziesii subsp. menziesii	Drosera menziesii	Nomenclature update
Drosera menziesii subsp. penicillaris	Drosera drummondii	Nomenclature update
Drosera gigantea subsp. gigantea	Drosera gigantea	Nomenclature update
Drosera parvula	Drosera minutiflora	Taxonomic concept updated. Drosera parvula transferred to Drosera paleacea, which is not known from the Cooljarloo area. Likely attributable to Drosera minutiflora
Grevillea thelemanniana subsp. Cooljarloo (B.J. Keighery 28 B)	Grevillea cooljarloo	Nomenclature update
Grevillea preissii subsp. glabrilimba	Grevillea glabrilimba	Nomenclature update



Name in Cooljarloo West Dataset	Updated Name	Reasoning
Grevillea preissii subsp. preissii	Grevillea preissii	Nomenclature update
Hakea spathulata	Hakea neospathulata	Nomenclature update
Harperia lateriflora	Desmocladus lateriflorus	Nomenclature update
Hemiandra glabra subsp. glabra ms	Hemiandra glabra	Nomenclature update
Hibbertia huegelii	Hibbertia striata	Previously applied concept of Hibbertia huegelii determined to comprise two distinct taxa, including a recombined Hibbertia striata. Hibbertia huegelii recircumscribed and no longer known from the Cooljarloo area
Hibbertia spicata subsp. leptotheca Hibbertia spicata subsp. spicata	Hibbertia spicata	Subspecies of <i>Hibbertia spicata</i> no longer recognised
Hibbertia sp. Gnangara (J.R. Wheeler 2329)	Hibbertia sericosepala	Nomenclature update
Hybanthus calycinus	Pigea calycina	Nomenclature update
Hypocalymma angustifolium (subsp. Swan Coastal Plain (G.J. Keighery 16777))	Hypocalymma balbakiae	Nomenclature update
Hypocalymma sp. Nambung (R. Spjut & R. Smith s.n. 22/09/1992)	Hypocalymma quadrangulare	Nomenclature update
Isotoma hypocrateriformis var. trichogramma	Isotoma hypocrateriformis	Nomenclature update
Leptospermum erubescens	Leptospermopsis erubescens	Nomenclature update
Leptospermum spinescens	Apectospermum spinescens	Nomenclature update
Leucopogon conostephioides	Styphelia conostephioides	Nomenclature update
Leucopogon glaucifolius	Styphelia glaucifolia	Nomenclature update
Leucopogon leptanthus	Styphelia leptantha	Nomenclature update
Leucopogon propinquus	Styphelia propinqua	Nomenclature update
Leucopogon sp. Lesueur (B. Evans 530)	Leucopogon stenophyllus	Nomenclature update
Leucopogon sp. Moore River (M. Hislop 1695)	Styphelia ciliosa	Nomenclature update
Logania spermacocea	Orianthera spermacocea	Nomenclature update
Lysinema ciliatum	Lysinema pentapetalum	Lysinema ciliatum circumscribed in 2009, and no longer known from the Cooljarloo area. Lysinema pentapetalum reinstated for the majority of specimens previously ascribed to Lysinema ciliatum
<i>Malleostemon</i> sp. Cooljarloo (B. Backhouse s.n. 16/11/88) (P1)	Babingtonia delicata	Nomenclature update
Meeboldina cana	Leptocarpus canus	Nomenclature update
Meeboldina coangustata	Leptocarpus coangustatus	Nomenclature update
Onychosepalum nodatum	Desmocladus nodatus	Nomenclature update



Name in Cooljarloo West Dataset	Updated Name	Reasoning
Platysace juncea sens. lat.	Platysace juncea	Representative specimen of Platysace juncea sens. lat. identified by WA Herbarium as Platysace juncea (PERTH 08488614)
Sarcocornia quinqueflora	Salicornia quinqueflora	Nomenclature update
Schoenus curvifolius	Chaetospora curvifolia	Nomenclature update
Schoenus grandiflorus	Ammothryon grandiflorum	Nomenclature update
Scholtzia leptantha	Scholtzia obovata	Nomenclature update
Stylidium sp. Kalbarri (A. Carr 145)	Stylidium ponticulus	Nomenclature update
Tetraria microcarpa	Morelotia microcarpa	Nomenclature update
Tetraria octandra	Morelotia octandra	Nomenclature update
Tricostularia neesii var. neesii	Tricostularia neesii	Nomenclature update
Velleia trinervis	Goodenia trinervis	Nomenclature update
Verreauxia reinwardtii	Goodenia reinwardtii	Nomenclature update





Analysis with quadrats within the Survey Area only (i.e. analyses one and two)

Note: Table B.1 does not include taxa omitted from the analyses (as per Section 3.6 and Table B.2).

Table B.1 Flora Taxa Amalgamated in Floristic Classification Analyses One and Two

Таха	Reason for Amalgamation
Acacia pulchella var. glaberrima Acacia pulchella var. pulchella Acacia pulchella var. reflexa	Varieties are difficult to distinguish if material is inadequate
Calytrix fraseri Calytrix ?fraseri	Likely represent the same entity
Calothamnus quadrifidus subsp. angustifolius Calothamnus quadrifidus subsp. quadrifidus	As per Woodman Environmental (2014b)
Cassytha glabella forma bicallosa Cassytha glabella forma casuarinae Cassytha glabella forma dispar	Forms cannot be distinguished if material is inadequate
Cassytha racemosa Cassytha racemosa forma pilosa Cassytha racemosa forma racemosa	Forms cannot be distinguished if material is inadequate
Conostylis ?aculeata Conostylis aculeata subsp. breviflora Conostylis aculeata subsp. spinuligera	Subspecies are difficult to distinguish if material is inadequate
Conostylis aurea Conostylis ?aurea	Likely represent the same entity
Conostylis juncea Conostylis ?juncea	Likely represent the same entity
Cyathochaeta avenacea Cyathochaeta ?avenacea	Likely represent the same entity
Daviesia decurrens Daviesia decurrens subsp. decurrens	Daviesia decurrens subsp. decurrens is the only subspecies known from the Cooljarloo area
Daviesia incrassata Daviesia incrassata subsp. incrassata Daviesia incrassata subsp. teres	Subspecies are difficult to distinguish if material is inadequate
Eremaea pauciflora Eremaea pauciflora var. lonchophylla Eremaea pauciflora var. pauciflora	Varieties are difficult to distinguish if material is inadequate
Haemodorum spicatum Haemodorum ?spicatum	Likely represent the same entity
Hibbertia crassifolia Hibbertia ?crassifolia	Likely represent the same entity
Hibbertia hypericoides Hibbertia hypericoides subsp. hypericoides	Hibbertia hypericoides subsp. hypericoides is the only subspecies known from the Cooljarloo area
Hibbertia pubens Hibbertia sericosepala	Hibbertia pubens and Hibbertia sericosepala are superficially similar. Hibbertia pubens was published in 2018, subsequent to the Cooljarloo West assessment
Laxmannia sessiliflora subsp. ?australis Laxmannia sessiliflora subsp. sessiliflora	Subspecies are difficult to distinguish if material is inadequate
Lepidobolus preissianus Lepidobolus preissianus subsp. preissianus	Lepidobolus preissianus subsp. preissianus is the only subspecies known from the Cooljarloo area



Таха	Reason for Amalgamation
Lepidosperma pubisquameum Lepidosperma cf. pubisquameum	Lepidosperma genus undergone revision since Cooljarloo West assessment (this revision still ongoing). Most likely comparison
Lomandra ?hermaphrodita Lomandra hermaphrodita	Likely represent the same entity
Patersonia occidentalis Patersonia occidentalis var. occidentalis	Likely represent the same entity; other varieties that occur in the Cooljarloo area are typically easily distinguishable, even in the absence of flowering material
Petrophile brevifolia Petrophile brevifolia sens. lat.	Wider taxon concept accepted since Cooljarloo West assessment
Pimelea imbricata var. piligera Pimelea imbricata var. ?piligera	Likely represent the same entity
Schoenus subfascicularis Schoenus ?subfascicularis	Likely represent the same entity
Stylidium androsaceum Stylidium calcaratum Stylidium perpusillum	Taxa can be difficult to distinguish in the field
Thysanotus manglesianus Thysanotus patersonii	Taxa can be difficult to distinguish when material is inadequate
Tricoryne elatior Tricoryne ?elatior	Likely represent the same entity



Note: **Table B.2** does not include taxa belonging to the following categories that were removed prior to the classification analyses (as per **Section 3.6**):

- Annual taxa
- Introduced taxa
- Hybrids
- Singletons.

Table B.2 Flora Taxa Omitted from Floristic Classification Analyses One and Two

Taxon	Reason for Omission
?Angianthus tomentosus	Indeterminate
Anigozanthos sp.	Indeterminate
Asteraceae sp.	Indeterminate
Austrostipa sp.	Indeterminate
Caladenia ?flava Caladenia flava subsp. flava	Ephemeral
Caladenia longicauda subsp. albella	Ephemeral
Caladenia sp.	Indeterminate/ephemeral
Carpobrotus sp.	Indeterminate
Chamaescilla versicolor	Ephemeral
Drosera drummondii Drosera ?drummondii	Ephemeral
Drosera eneabba Drosera ?eneabba	Ephemeral
Drosera erythrorhiza	Ephemeral
Drosera gigantea	Ephemeral
Drosera glanduligera	Ephemeral
Drosera humilis	Ephemeral
Drosera menziesii Drosera ?menziesii	Ephemeral
Drosera minutiflora	Ephemeral
Drosera thysanosepala	Ephemeral
Drosera sp.	Indeterminate
Elythranthera brunonis	Ephemeral
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) (P3)	Ephemeral
?Exocarpos sp.	Indeterminate
Gyrostemon subnudus	Short-lived perennial
?Hakea ruscifolia	Indeterminate
?Mesomelaena pseudostygia	Indeterminate
?Microtis sp.	Indeterminate
?Paracaleana sp.	Indeterminate



Taxon	Reason for Omission
Philydrella pygmaea subsp. pygmaea	Ephemeral
?Podolepis sp.	Indeterminate
Pterostylis vittata	Ephemeral
Pyrorchis nigricans	Ephemeral
Rytidosperma sp.	Indeterminate
Stylidium sp.	Indeterminate
Thelymitra vulgaris	Ephemeral
Tribonanthes australis	Ephemeral
Tribonanthes variabilis	Ephemeral
?Viminaria juncea	Indeterminate
Wurmbea dioica subsp. alba	Ephemeral



Analysis with quadrats from the wider Cooljarloo West Study Area (i.e. analysis three)

Note: Table B.3 does not include taxa omitted from the analysis (as per Section 3.8 and Table B.4).

 Table B.3
 Flora Taxa Amalgamated in Floristic Classification Analysis Three

Таха	Reason for Amalgamation
Acacia lasiocarpa Acacia lasiocarpa var. ?bracteolata Acacia lasiocarpa var. lasiocarpa	Varieties are difficult to distinguish if material is inadequate
Acacia pulchella Acacia pulchella var. glaberrima Acacia pulchella var. pulchella Acacia pulchella var. reflexa	Varieties are difficult to distinguish if material is inadequate
Acacia saligna Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602)	Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602) is the only subspecies known from the Cooljarloo area
Adenanthos cygnorum Adenanthos cygnorum subsp. cygnorum	Adenanthos cygnorum subsp. cygnorum is the only subspecies known from the Cooljarloo area
Allocasuarina lehmanniana Allocasuarina lehmanniana subsp. lehmanniana	Allocasuarina lehmanniana subsp. lehmanniana is the only subspecies known from the Cooljarloo area
Amphipogon caricinus var. caricinus Amphipogon debilis	Amphipogon caricinus var. caricinus not recorded by the Cooljarloo West assessment, but is superficially similar to Amphipogon debilis
Angianthus preissianus Angianthus ?preissianus	Likely represent the same entity
Anigozanthos ?pulcherrimus Anigozanthos pulcherrimus	Likely represent the same entity
Banksia dallanneyi Banksia dallanneyi subsp. dallanneyi Banksia dallanneyi subsp. media	As per Woodman Environmental (2014b)
Calytrix depressa Calytrix ?depressa	Likely represent the same entity
Calytrix flavescens Calytrix ?flavescens	Likely represent the same entity
Calytrix fraseri Calytrix ?fraseri	Likely represent the same entity
Calothamnus quadrifidus Calothamnus quadrifidus subsp. angustifolius Calothamnus quadrifidus subsp. quadrifidus	As per Woodman Environmental (2014b)
Carpobrotus modestus Carpobrotus ?modestus	Likely represent the same entity
Cassytha aurea Cassytha aurea var. hirta	Varieties cannot be distinguished if material is inadequate
Cassytha flava Cassytha ?flava	Likely represent the same entity
Cassytha glabella Cassytha glabella forma bicallosa Cassytha glabella forma casuarinae Cassytha glabella forma dispar Cassytha glabella forma ?glabella	Forms cannot be distinguished if material is inadequate



Таха	Reason for Amalgamation
Cassytha racemosa Cassytha racemosa forma pilosa Cassytha racemosa forma racemosa	Forms cannot be distinguished if material is inadequate
Chordifex sinuosus Chordifex ?sinuosus	Likely represent the same entity
Comesperma calymega Comesperma ?calymega	Likely represent the same entity
Comesperma integerrimum Comesperma ?integerrimum	Likely represent the same entity
Conospermum stoechadis Conospermum stoechadis subsp. sclerophyllum Conospermum stoechadis subsp. stoechadis	Subspecies are difficult to distinguish if material is inadequate
Conostephium pendulum Conostephium ?pendulum	Likely represent the same entity
Conostylis aculeata Conostylis aculeata subsp. breviflora Conostylis aculeata subsp. spinuligera	Subspecies are difficult to distinguish if material is inadequate
Conostylis aurea Conostylis ?aurea	Likely represent the same entity
Conostylis candicans Conostylis candicans subsp. calcicola	Subspecies are difficult to distinguish if material is inadequate
Conostylis crassinerva subsp. absens Conostylis crassinerva subsp. crassinerva	Subspecies are difficult to distinguish if material is inadequate
Conostylis festucacea subsp. festucacea Conostylis ?festucacea subsp. festucacea	Likely represent the same entity
Conostylis juncea Conostylis ?juncea	Likely represent the same entity
Corynotheca micrantha Corynotheca ?elongata	Taxa can be difficult to distinguish if material is inadequate
Cryptandra myriantha Cryptandra ?myriantha	Likely represent the same entity
Cyathochaeta avenacea Cyathochaeta ?avenacea	Likely represent the same entity
Daviesia decurrens Daviesia decurrens subsp. decurrens	Daviesia decurrens subsp. decurrens is the only subspecies known from the Cooljarloo area
Daviesia divaricata Daviesia divaricata subsp. divaricata	Daviesia divaricata subsp. divaricata is the only subspecies known from the Cooljarloo area
Daviesia incrassata Daviesia incrassata subsp. incrassata Daviesia incrassata subsp. teres	Subspecies are difficult to distinguish if material is inadequate
Desmocladus flexuosus Desmocladus ?flexuosus	Likely represent the same entity
Desmocladus lateriticus Desmocladus ?lateriticus	Likely represent the same entity
Dianella revoluta Dianella revoluta var. divaricata	Dianella revoluta var. divaricata is the only variety known from the Cooljarloo area



Taxa	Reason for Amalgamation
Eremaea asterocarpa	Eremaea asterocarpa subsp. asterocarpa is the only subspecies
Eremaea asterocarpa subsp. asterocarpa	known from the Cooljarloo area
Eremaea beaufortioides Eremaea beaufortioides var. beaufortioides	Eremaea beaufortioides var. beaufortioides is the only variety known from the Cooljarloo area
Eremaea pauciflora	Varieties are difficult to distinguish if material is inadequate
Eremaea pauciflora var. lonchophylla Eremaea pauciflora var. pauciflora	
Eremophila glabra subsp. carnosa Eremophila glabra subsp. ?carnosa	Likely represent the same entity
Gompholobium knightianum Gompholobium ?knightianum	Likely represent the same entity
Gonocarpus pithyoides Gonocarpus ?pithyoides	Likely represent the same entity
Goodenia coerulea Goodenia ?coerulea	Likely represent the same entity
Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)	Likely represent the same entity
Goodenia ?pulchella subsp. Coastal Plain A (M. Hislop 634)	
Grevillea cooljarloo Grevillea ?cooljarloo	Likely represent the same entity
Grevillea preissii Grevillea ?preissii	Likely represent the same entity
Haemodorum spicatum Haemodorum ?spicatum	Likely represent the same entity
Hemiandra glabra Hemiandra ?glabra	Likely represent the same entity
Hemiandra linearis Hemiandra ?linearis	Likely represent the same entity
Hibbertia crassifolia Hibbertia ?crassifolia Hibbertia aff. crassifolia	As per Woodman Environmental (2014b)
Hibbertia hypericoides Hibbertia hypericoides subsp. hypericoides	Hibbertia hypericoides subsp. hypericoides is the only subspecies known from the Cooljarloo area
Hibbertia pubens Hibbertia sericosepala	Hibbertia pubens and Hibbertia sericosepala are superficially similar. Hibbertia pubens was published in 2018, subsequent to the Cooljarloo West assessment
Hibbertia spicata Hibbertia ?spicata	Likely represent the same entity
Hypocalymma balbakiae (Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)) Hypocalymma suave	Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777) now known as Hypocalymma balbakiae. Hypocalymma suave is a member of the Hypocalymma. angustifolium complex and was reinstated in 2023
Isotropis cuneifolia Isotropis cuneifolia subsp. cuneifolia	Likely represent the same entity
Johnsonia pubescens Johnsonia pubescens subsp. pubescens	Johnsonia pubescens subsp. pubescens is the only subspecies known from the Cooljarloo area



Таха	Reason for Amalgamation
Kunzea micrantha Kunzea micrantha subsp. petiolata	Kunzea micrantha subsp. petiolata is the only subspecies known from the Cooljarloo area
Lambertia multiflora Lambertia multiflora var. multiflora	Lambertia multiflora var. multiflora is the only variety known from the Cooljarloo area
Laxmannia sessiliflora Laxmannia sessiliflora subsp. ?australis Laxmannia sessiliflora subsp. sessiliflora	Subspecies are difficult to distinguish if material is inadequate
Lepidosperma longitudinale Lepidosperma ?longitudinale	Likely represent the same entity
Lepidobolus preissianus Lepidobolus preissianus subsp. preissianus	Lepidobolus preissianus subsp. preissianus is the only subspecies known from the Cooljarloo area
Lepidosperma pubisquameum Lepidosperma cf. pubisquameum	Lepidosperma genus undergone revision since Cooljarloo West assessment (this revision still ongoing). Most likely comparison
Styphelia conostephioides Styphelia conostephioides sens. lat.	As per Woodman Environmental (2014b)
Leucopogon oldfieldii Leucopogon ?oldfieldii	Likely represent the same entity
Leucopogon sprengelioides Leucopogon ?sprengelioides	Likely represent the same entity
Lomandra hermaphrodita Lomandra ?hermaphrodita	Likely represent the same entity
Lomandra micrantha Lomandra ?micrantha	Likely represent the same entity
Leptocarpus coangustatus Leptocarpus ?coangustatus	Likely represent the same entity
Melaleuca acutifolia Melaleuca ?acutifolia	Likely represent the same entity
Melaleuca carrii Melaleuca clavifolia	Melaleuca carrii is superficially similar to Melaleuca clavifolia
Melaleuca lateritia Melaleuca ?lateritia	Likely represent the same entity
Melaleuca rhaphiophylla Melaleuca ?rhaphiophylla	Likely represent the same entity
Melaleuca systena Melaleuca ?systena	Likely represent the same entity
Melaleuca viminea Melaleuca viminea subsp. viminea	Melaleuca viminea subsp. viminea is the only subspecies known from the Cooljarloo area
Opercularia vaginata Opercularia ?vaginata	Likely represent the same entity
Patersonia occidentalis Patersonia occidentalis var. occidentalis	Likely represent the same entity; other varieties that occur in the <i>Cooljarloo</i> area are typically easily distinguishable, even in the absence of flowering material
Pericalymma ellipticum Pericalymma ellipticum var. ellipticum Pericalymma ellipticum var. floridum	Varieties are difficult to distinguish if material is inadequate
Petrophile brevifolia Petrophile brevifolia sens. lat.	Wider taxon concept accepted since <i>Cooljarloo</i> West assessment



Таха	Reason for Amalgamation
Petrophile seminuda Petrophile ?seminuda	Likely represent the same entity
Pimelea imbricata var. piligera Pimelea imbricata var. ?piligera	Likely represent the same entity
Pimelea sulphurea Pimelea ?sulphurea	Likely represent the same entity
Rhagodia baccata Rhagodia baccata subsp. baccata	Likely represent the same entity; Rhagodia baccata subsp. baccata is the most common variety in the Cooljarloo area, and can be distinguished from Rhagodia baccata subsp. dioida when sterile
Rytidosperma occidentale Rytidosperma ?occidentale	Likely represent the same entity
Scaevola anchusifolia Scaevola ?anchusifolia	Likely represent the same entity
Scaevola lanceolata Scaevola ?lanceolata	Likely represent the same entity
Scaevola repens Scaevola repens subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8445) Scaevola repens var. repens	Varieties/subspecies can be difficult to distinguish if material is inadequate
Schoenus brevisetis Schoenus ?brevisetis	Likely represent the same entity
Schoenus caespititius Schoenus ?caespititius Schoenus aff. caespititius	Taxon complex requires revision
Scholtzia involucrata Scholtzia sp. Wongonderrah (M.E. & M.R. Trudgen MET 12000)	Taxa can be difficult to distinguish if material is inadequate
Scholtzia laxiflora Scholtzia ?laxiflora	Likely represent the same entity
Schoenus pedicellatus Schoenus ?pedicellatus	Likely represent the same entity
Schoenus rigens Schoenus ?rigens	Likely represent the same entity
Schoenus subfascicularis Schoenus ?subfascicularis	Likely represent the same entity
Schoenus unispiculatus Schoenus ?unispiculatus	Likely represent the same entity
Siloxerus humifusus Siloxerus ?humifusus	Likely represent the same entity
Stackhousia monogyna Stackhousia ?monogyna	Likely represent the same entity
Stenanthemum notiale Stenanthemum notiale subsp. chamelum Stenanthemum notiale subsp. notiale	Subspecies can be difficult to distinguish if material is inadequate
Stirlingia abrotanoides Stirlingia ?abrotanoides	Likely represent the same entity



Taxa	Reason for Amalgamation
Stylidium bicolor Stylidium piliferum	Stylidium piliferum complex revised subsequent to Cooljarloo West assessment. Stylidium bicolor was previously a subspecies of Stylidium piliferum
Stylidium dichotomum Stylidium aff. dichotomum	Unclear identity, likely represent the same entity
Stylidium diuroides Stylidium diuroides subsp. diuroides Stylidium diuroides subsp. paucifoliatum	Subspecies can be difficult to distinguish if material is inadequate
Synaphea spinulosa Synaphea spinulosa subsp. spinulosa	Synaphea spinulosa subsp. spinulosa is the only subspecies known from the Cooljarloo area
Thysanotus arbuscula Thysanotus ?arbuscula	Likely represent the same entity
Thysanotus manglesianus Thysanotus ?manglesianus	Likely represent the same entity
Thysanotus sparteus Thysanotus ?sparteus	Likely represent the same entity
Thysanotus thyrsoideus Thysanotus ?thyrsoideus	Likely represent the same entity
Tricoryne elatior Tricoryne ?elatior	Likely represent the same entity
Verticordia densiflora Verticordia densiflora var. cespitosa Verticordia densiflora var. densiflora	Varieties can be difficult to distinguish if material is inadequate
Verticordia lindleyi subsp. lindleyi Verticordia ?lindleyi subsp. lindleyi	Likely represent the same entity



Note: **Table B.4** does not include taxa belonging to the following categories that were removed prior to the classification analyses (as per **Section 3.6**):

- Annual taxa
- Introduced taxa
- Hybrids
- Singletons.

Table B.4 Flora Taxa Omitted from Floristic Classification Analysis Three

Taxon	Reason for Omission
Acacia sp.	Indeterminate
?Adriana sp.	Indeterminate
Amphipogon sp. ?Amphipogon sp.	Indeterminate
Anigozanthos sp. ?Anigozanthos sp.	Indeterminate
?Anthosachne sp.	Indeterminate
?Arnocrinum sp.	Indeterminate
Asparagaceae sp.	Indeterminate
Austrostipa sp.	Indeterminate
?Babingtonia delicata	Indeterminate
?Baeckea sp.	Indeterminate
?Billardiera sp.	Indeterminate
Burchardia sp.	Indeterminate
Caladenia flava Caladenia ?flava Caladenia flava subsp. flava Caladenia ?flava subsp. flava	Ephemeral
Caladenia longicauda Caladenia longicauda subsp. albella Caladenia ?longicauda	Ephemeral
Caladenia sp.	Ephemeral/indeterminate
Carpobrotus sp.	Indeterminate
Cassytha sp.	Indeterminate
Chamaescilla corymbosa	Ephemeral
Chamaescilla versicolor	Ephemeral
?Chordifex sp.	Indeterminate
Comesperma sp. ?Comesperma sp.	Indeterminate
Conospermum sp.	Indeterminate
Conostylis sp.	Indeterminate
conostyns sp.	
Diuris ?eburnea	Ephemeral



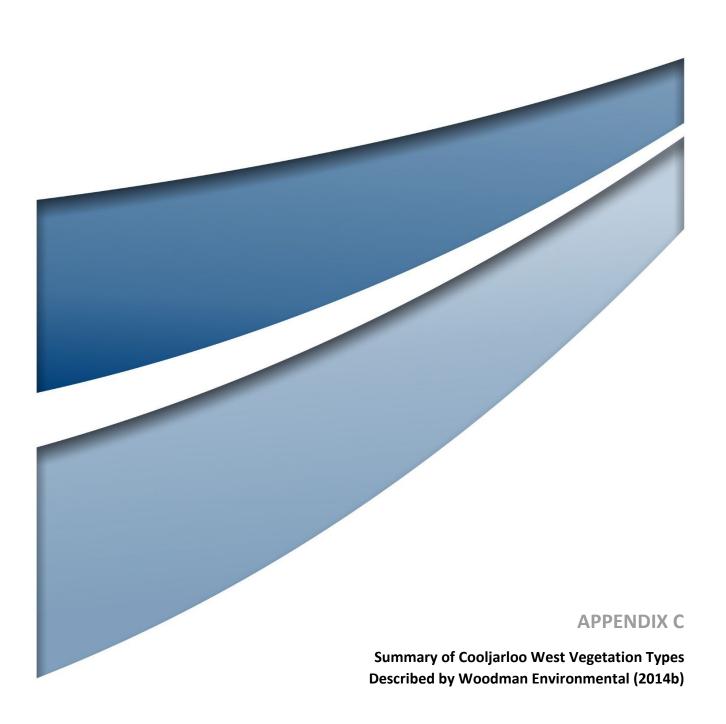
Taxon	Reason for Omission
Drosera closterostigma	Ephemeral
Drosera ?closterostigma	
Drosera drummondii Drosera ?drummondii	Ephemeral
Drosera eneabba Drosera ?eneabba	Ephemeral
Drosera erythrorhiza	Ephemeral
Drosera gigantea	Ephemeral
Drosera heterophylla	Ephemeral
Drosera humilis	Ephemeral
Drosera macrantha	Ephemeral
Drosera magna Drosera ?magna	Ephemeral
Drosera menziesii Drosera ?menziesii	Ephemeral
Drosera minutiflora	Ephemeral
Drosera pallida	Ephemeral
Drosera spilos	Ephemeral
Drosera stolonifera	Ephemeral
Drosera thysanosepala	Ephemeral
Drosera sp.	Ephemeral/indeterminate
Elythranthera brunonis	Ephemeral
Eremaea sp.	Indeterminate
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	Ephemeral
?Exocarpos sp.	Indeterminate
?Gonocarpus sp.	Indeterminate
?Goodenia coerulea	Indeterminate
Goodenia sp.	Indeterminate
Goodeniaceae sp.	Indeterminate
?Grevillea sp.	Indeterminate
Gyrostemon subnudus	Short-lived perennial
Haemodorum sp.	Indeterminate
?Hakea ruscifolia	Indeterminate
Hibbertia sp.	Indeterminate
Indet. sp.	Indeterminate
Jacksonia sp.	Indeterminate
Kunzea sp.	Indeterminate
?Lasiopetalum lineare	Indeterminate
Lechenaultia sp.	Indeterminate
?Lepidosperma pubisquameum	Indeterminate



Taxon	Reason for Omission
Lepidosperma sp.	Indeterminate
?Lepidosperma sp.	
Leporella fimbriata	Ephemeral
Leucopogon sp.	Indeterminate
Lomandra sp.	Indeterminate
?Lomandra sp.	
Macarthuria keigheryi	Short-lived perennial, fire and disturbance opportunist
Melaleuca sp.	Indeterminate
?Mesomelaena pseudostygia	Indeterminate
Microtis media subsp. media	Ephemeral
Microtis orbicularis	Ephemeral/indeterminate
?Microtis sp.	Indeterminate
?Myoporum sp.	Indeterminate
Myrtaceae sp.	Indeterminate
Orchidaceae sp.	Ephemeral/indeterminate
Oxalis sp.	Indeterminate
Paracaleana nigrita	Ephemeral
?Paracaleana sp.	Ephemeral/indeterminate
?Patersonia sp.	Indeterminate
Philydrella pygmaea subsp. pygmaea	Ephemeral
?Phlebocarya sp.	Indeterminate
?Pileanthus sp.	Indeterminate
Pimelea sp.	Indeterminate
?Platysace sp.	Indeterminate
Poaceae sp.	Indeterminate
?Podolepis sp.	Indeterminate
Proteaceae sp.	Indeterminate
Pterostylis ?pyramidalis	Ephemeral
Pterostylis vittata Pterostylis ?vittata	Ephemeral
Pyrorchis nigricans	Ephemeral
Restionaceae sp.	Indeterminate
Rytidosperma sp. ?Rytidosperma sp.	Indeterminate
?Scaevola sp.	Indeterminate
?Schoenolaena juncea	Indeterminate
Schoenus sp. ?Schoenus sp.	Indeterminate
Scholtzia sp. ?Scholtzia sp.	Indeterminate
Stylidium sp.	Indeterminate
?Morelotia octandra	Indeterminate



Taxon	Reason for Omission
Thelymitra benthamiana	Ephemeral
Thelymitra campanulata	Ephemeral
Thelymitra vulgaris	Ephemeral
?Thysanotus multiflorus	Indeterminate
Thysanotus sp. ?Thysanotus sp.	Indeterminate
Tribonanthes australis	Ephemeral
Tribonanthes variabilis	Ephemeral
?Tricoryne sp.	Indeterminate
Unidentified sp. 1	Indeterminate
?Viminaria juncea	Indeterminate
Wurmbea dioica Wurmbea dioica subsp. alba	Ephemeral
Wurmbea sp.	Ephemeral/indeterminate





*Note: the following text has been taken from Woodman Environmental (2014b), and therefore references to appendices and figures refer to those in Woodman Environmental (2014b). Taxonomy nomenclature has been updated where required.

SUPER-GROUP 1

General Description: Comprised of various vegetation types, all related to conditions of greater water availability. Includes:

- Sedgelands over forbs on non-saline flats.
- Samphire Shrubland on saline flats.
- Open to Closed Heathlands to Shrublands on damp depressions and drainage lines to undulating plains, and areas with laterite or limestone influence.
- Woodlands dominated by mixed species including *Banksia*, *Eucalyptus* and *Melaleuca* on drainage lines, damp depressions and edges of claypans.

Super-group 1 is comprised of VTs 1 through to 16, and generally consists of vegetation associated with either wetland habitats (VT 1 to 5, 9a to 14, and 16), areas of higher moisture retention (i.e. soils with a clay content or impeding layer) (VT 6 and 7) or areas where limestone had been noted (VT 8 and 15). No particular Species Group was dominant within the VTs of Super-group 1 however there is a distinct lack of dominance by taxa from Species Group S, which are dominant in VTs of Super-group 2 (Appendix R). Species group N is fairly consistent throughout Super-group 1, including taxa such as *Banksia telmatiaea*, *Melaleuca seriata*, *Verticordia densiflora* and *Regelia ciliata*, which are typically found in wetter sites.

Super-group 1 has a much higher diversity of vegetation types in comparison to Super-group 2, despite it occupying a much smaller portion of the survey area (26 %). This is due both to the more diverse landform and soil types in this Super-group in comparison to Super-group 2, and the higher diversity of species groupings of woodlands and heaths within these wetter areas in comparison to similar vegetation structures in drier areas. VTs typical to Super-group 1 included those mapped on broad depressions to undulating plains, claypans, drainage lines, ridges and dunes with limestone outcropping, saline flats, non-saline flats and areas with lateritic outcropping. Likewise, there is a high diversity of vegetation structure, ranging from Sedgelands, Open to Closed Heaths, Shrublands and Woodlands.

The average taxon richness of VTs within Super-group 1 was somewhat variable, ranging from 1 native perennial taxon per quadrat (VT 16; average over two quadrats) to 38.7 native taxa per quadrat (VT 8; averaged over three quadrats). VT 16 also recorded the lowest number of native perennial taxa (a total of 2) in Super-group 1, while VT 1 recorded the most native perennial taxa (a total of 190). On average species richness was generally lower than that of Super-group 2 (Appendix P, Appendix U).

VTs 1 through to 16 are described briefly below, with detailed information presented in Appendix U.



Low Open Heathland to Mid Closed Heathland of *Acacia lasiocarpa* var. *lasiocarpa*, *Banksia telmatiaea*, *Melaleuca seriata*, *Hakea obliqua* subsp. *parviflora*, *Regelia ciliata* and/or *Verticordia densiflora* var. *densiflora*, often with Mid Isolated Clumps of Shrubs to Mid Sparse Shrubland of *Melaleuca rhaphiophylla* on white-grey to grey-brown sand, sandy loam or sandy clay in broad damp depressions on flat to gently undulating plains.

VT 2

Mid Sparse Shrubland to Mid Closed Shrubland of *Melaleuca acutifolia*, *Melaleuca brevifolia*, *Melaleuca rhaphiophylla* and/or *Melaleuca viminea* subsp. *viminea* over Low Isolated Clumps of Shrubs to Low Shrubland of *Calothamnus hirsutus*, *Calothamnus sanguineus* and *Grevillea cooljarloo* (P1) on grey to grey-brown sand, sandy loam or sandy clay in broad damp to wet depressions and drainage lines on flat to gently undulating plains.

VT 3

Low Isolated Clumps of Shrubs of *Regelia ciliata* and *Kunzea glabrescens* or Mid Shrubland of *Verticordia densiflora* var. *densiflora* over Low Isolated Clumps of Forbs of **Hypochaeris glabra* and *Trachymene pilosa* on white-grey sandy clay or grey-brown sand on the periphery of claypans.

VT 4

Mid Open Shrubland of *Acacia saligna* subsp. Wheatbelt (B.R. Maslin 8602) and *Calothamnus quadrifidus* over Mid Isolated Clumps of Sedges of *Lepidosperma longitudinale* over Low Open Grassland of **Briza maxima* and **Briza minor* on grey-brown sandy clay in drainage lines.

VT 5

Low Heathland to Mid Closed Heathland of *Banksia telmatiaea*, *Hakea obliqua* subsp. *parviflora*, *Melaleuca seriata* and/or *Regelia ciliata* on white-grey to grey-brown sand, sandy loam, sandy clay or clay loam in broad damp depressions on flat to gently undulating plains.

VT 6

Low Isolated Clumps of Trees to Low Woodland of *Banksia attenuata*, *Banksia menziesii* and/or *Banksia ilicifolia* over Low Sparse Shrubland to Mid Closed Shrubland of *Adenanthos cygnorum* subsp. *cygnorum*, *Banksia telmatiaea*, *Beaufortia squarrosa*, *Hypocalymma balbakiae*, *Jacksonia nutans* and/or *Melaleuca seriata* over Low Isolated Clumps of Sedges to Mid Sedgeland of *Anarthria laevis* and/or Low Isolated Clumps of Rushes of *Chordifex sinuosus* on white-grey to grey-brown sand in damp depressions.

VT 7

Low Sparse Heathland to Low Closed Heathland of *Allocasuarina* spp., *Calothamnus quadrifidus*, *Calothamnus sanguineus*, *Hakea incrassata*, *Hakea lissocarpha*, *Hibbertia crassifolia* and/or *Melaleuca seriata* over Low Isolated Clumps of Sedges to Mid Sparse Sedgeland of *Mesomelaena pseudostygia* and *Schoenus clandestinus* on white-grey to grey sand or white-grey sandy loam to yellow-brown clay loam with lateritic surface stones in broad dry depressions or gently undulating plains.



Mid Open Shrubland to Mid Shrubland of *Banksia leptophylla*, *Banksia sessilis* var. *cygnorum* and *Hakea trifurcata* over Low Open Shrubland to Low Shrubland of *Bossiaea eriocarpa*, *Calothamnus quadrifidus* subsp. *quadrifidus*, *Grevillea preissii*, *Hibbertia racemosa*, *Melaleuca systena* and *Scholtzia involucrata* on yellow-grey sand to yellow-brown sandy loam on ridges and dunes with limestone outcropping.

VT 9a

Mid Open Shrubland to Tall Closed Shrubland of *Melaleuca teretifolia, Melaleuca rhaphiophylla* and *Melaleuca viminea* subsp. *viminea*, occasionally with Mid Shrubs of *Melaleuca lateritia* and Low to Tall Sedges and Rushes of *Machaerina juncea, Chorizandra enodis, Leptocarpus coangustatus* and *Schoenus subfascicularis* on grey to grey-brown sandy loam or clay loam in broad shallow basins, wet flats and drainage lines.

VT 9b

Low Woodland to Mid Open Forest of *Eucalyptus rudis* subsp. *rudis* over Low Isolated Clumps of Trees to Low Closed Forest of *Melaleuca rhaphiophylla*, often with Tall Sparse Shrubland to Tall Shrubland of *Acacia saligna* subsp. Wheatbelt (B.R. Maslin 8602), over Low Isolated Clumps of Forbs to Low Closed Forbland of **Galium murale*, **Hypochaeris glabra*, **Lysimachia arvensis* and *Trachymene pilosa* on grey to grey-black sand, sandy loam, sandy clay or clayey sand in wetlands, broad shallow basins/depressions and drainage lines.

VT 10

Low Isolated Clumps of Trees to Mid Woodland of *Banksia littoralis* and *Melaleuca preissiana* over Tall Isolated Clumps of Shrubs to *Acacia saligna* subsp. Wheatbelt (B.R. Maslin 8602) and *Viminaria juncea* over Mid Sparse Shrubland to Mid Shrubland of *Hypocalymma balbakiae* and *Xanthorrhoea preissii* over Low Open Sedgeland to Mid Sedgeland of *Machaerina juncea, Cyathochaeta avenacea* and/or *Lepidosperma longitudinale* on grey to grey-black loamy sand in drainage lines, wet plains and edges of damp depressions.

VT 11

Mid Isolated Clumps of Trees to Mid Open Forest of *Corymbia calophylla, Eucalyptus rudis* subsp. *rudis* and *Melaleuca preissiana* over Low Isolated Clumps of Trees to Low Open Forest of *Melaleuca rhaphiophylla* over Tall Isolated Clumps of Shrubs to Tall Sparse Shrubland of *Acacia cyclops, Acacia saligna* and/or *Spyridium globulosum* over Mid Isolated Clumps of Shrubs to Mid Sparse Shrubland of *Xanthorrhoea preissii* with occasional Mid Clumps of Sedges of *Gahnia trifida* on white-grey to grey-brown sandy loam in drainage lines.

VT 12

Tall Shrubland to Tall Closed Shrubland of *Acacia saligna* ?subsp. Wheatbelt (B.R. Maslin 8602) and *Melaleuca rhaphiophylla* over Low Isolated Clumps of Sedges to Mid Open Sedgeland of *Lepidosperma* ?longitudinale on grey sand to dark brown loamy sand with ironstone outcropping in shallow basins.



Low Sparse Samphire Shrubland to Mid Samphire Shrubland of *Salicornia quinqueflora, Tecticornia* ?halocnemoides and/or Tecticornia indica subsp. bidens over Low Isolated Clumps of Shrubs to Low Open Shrubland of Frankenia pauciflora and/or Lawrencia squamata over Low Isolated Clumps of Forbs to Low Forbland of Angianthus micropodioides (P3) or Angianthus preissianus, *Hypochaeris glabra, *Lysimachia arvensis, *Polypogon monspeliensis and/or *Vulpia bromoides on white-grey to grey-brown sandy clay to clay on saline flats.

VT 14

Mid Woodland of *Casuarina obesa* over Mid Sparse Shrubland to Tall Closed Shrubland of *Melaleuca acutifolia, Melaleuca brevifolia* and/or *Melaleuca viminea* subsp. *viminea* over Mid Isolated to Tall Isolated Clumps of Sedges of *Machaerina juncea* and *Gahnia trifida* or Low Isolated Clumps of Shrubs of *Calothamnus hirsutus, Grevillea cooljarloo* (P1) and *Verticordia densiflora* on grey-white to grey-brown clayey sand on saline flats.

VT 15

Low Woodland of *Eucalyptus decipiens* or Low *Mallee* Woodland of *Eucalyptus foecunda* over Mid Closed Shrubland of *Acacia spathulifolia* and *Banksia sessilis* over Low Sparse Shrubland of *Acacia lasiocarpa* var. *lasiocarpa*, *Calothamnus quadrifidus*, *Leucopogon parviflorus* and/or *Melaleuca systena* on grey-brown to yellow-grey sand or loamy sand on low rises or ridges with limestone surface stones; or Tall Isolated Clumps of Shrubs of *Allocasuarina lehmanniana* over Mid Open Shrubland of *Anthocercis ilicifolia* and *Spyridium globulosum* over Low Isolated Clumps of Shrubs of *Acacia lasiocarpa* var. *lasiocarpa* and *Leucopogon parviflorus* on yellow-brown sand on the periphery of claypans.

VT 16

Low Sedgeland of *Chaetospora curvifolia* and/or Low Isolated Clumps of Forbs to Low Closed Forbland of **Dittrichia graveolens*, **Lysimachia arvensis*, *Pogonolepis stricta*, * *Bellardia viscosa*, *Brachyscome bellidioides*, *Calandrinia* sp. Kenwick (G.J. Keighery 10905), *Goodenia pulchella* subsp. Coastal Plain A (M. Hislop 634) and *Wurmbea* sp. on grey to grey-brown sandy clay loam on non-saline flats.



SUPER-GROUP 2

General Description: Dominated by Low Isolated Clumps of Trees to Low Open Forest of mixed *Banksia attenuata*, *Banksia menziesii* and occasionally *Eucalyptus todtiana* and *Banksia prionotes*, over general species rich Low Shrubland dominated by mixed species including *Bossiaea eriocarpa*, *Eremaea pauciflora*, *Melaleuca clavifolia*, *Hibbertia hypericoides*, *Jacksonia nutans* and *Mesomelaena pseudostygia* on white, grey or yellow sand to sandy clay on dunes to undulating plains, to open depressions and flats; Heaths typically present on depressions and flats with greater levels of clay present.

Super-group 2 is comprised of VTs 17 and 18, occupying approximately 66 % of the survey area. This group consists of Banksia Woodland to Shrubland with emergent *Banksia* on undulating plains and dunes of deeper sand. The landforms and associated soils upon which VT 17 and 18 were mapped are relatively similar, with VT 17 generally associated with white sand and VT 18 with yellow sand and a laterite influence. The Woodland forms of VT 17 and 18 are difficult to interpret in the field and from aerial photography, without the confidence of quadrat data.

VTs within Super-group 2 generally grouped together due to the presence of taxa from Species Group S (Appendix R), which is dominated by taxa which typically inhabit dry sandy soils, including *Banksia menziesii*, *Banksia attenuata*, *Dasypogon obliquifolius*, *Bossiaea eriocarpa*, *Eremaea asterocarpa*, *Jacksonia nutans*, *Melaleuca clavifolia* and *Hibbertia hypericoides*. Other Species Groups that were represented included H and M, however these species were not consistently represented to the extent as those in Species Group S (Appendix R).

Super-group 2 was mapped in areas from open depressions (not water gaining), plains, and lower slopes through to upper slopes and dune crests. A large portion of this Super-group was mapped on areas with deeper sands, and in these areas the vegetation structure was characterised by Woodlands dominated by a variety of *Banksia* species; however, areas of shallower sands with a higher clay content were also represented, where the structure of the vegetation consisted of species-rich mixed Heath, often with occasional emergent *Banksia* trees or *Nuytsia floribunda*.

The taxon richness of VTs within Super-group 2 was similar, with a mean richness of 37.3 native taxa per quadrat for VT 17 and 40.1 native taxa per quadrat for VT 18. The number of native taxa was also similar, with 233 species recorded in VT 17 and 234 species in VT 18. VT 18 had a greater variation in structure and species richness than VT 17. On average species richness was generally higher than that of Super-group 1.

VTs 17 and 18 are described briefly below, with detailed information presented in Appendix U.

VT 17

Low Isolated Clumps of Trees to Low Open Forest of Banksia attenuata, Banksia menziesii and Eucalyptus todtiana over Mid Isolated Clumps of Shrubs to Mid Shrubland of Adenanthos cygnorum subsp. cygnorum, Eremaea pauciflora, Jacksonia floribunda, Jacksonia nutans, Stirlingia latifolia and Xanthorrhoea preissii over Low Isolated Clumps of Shrubs to Low Shrubland of Bossiaea eriocarpa, Dasypogon obliquifolius, Eremaea asterocarpa subsp. asterocarpa, Eremaea pauciflora, Hibbertia crassifolia, Hibbertia hypericoides, Jacksonia nutans, Melaleuca clavifolia, Patersonia occidentalis var. ?occidentalis and Petrophile linearis over Low Isolated Clumps of Sedges to Mid Open Sedgeland of Mesomelaena pseudostygia on white or grey sand on undulating plains and low dunes.



Low Isolated Clumps of Trees to Low Open Forest of *Banksia attenuata* and *Banksia menziesii* over Mid Isolated Clumps of Shrubs to Mid Shrubland of *Allocasuarina humilis*, *Conospermum stoechadis* subsp. *stoechadis*, *Eremaea pauciflora*, *Hakea costata* and/or *Xanthorrhoea preissii* over Low Isolated Clumps of Shrubs to Low Closed Shrubland of *Bossiaea eriocarpa*, *Calothamnus sanguineus*, *Dasypogon obliquifolius*, *Eremaea pauciflora*, *Hibbertia hypericoides*, *Jacksonia nutans* and/or *Melaleuca clavifolia* over Low Isolated Clumps of Sedges to Mid Open Sedgeland of *Mesomelaena pseudostygia* on grey to yellow-grey sand on undulating plains and low dunes or white-grey to grey-brown sand, sandy loam or sandy clay loam on simple slopes, open depressions or flats within undulating plains.

OTHER AREAS MAPPED

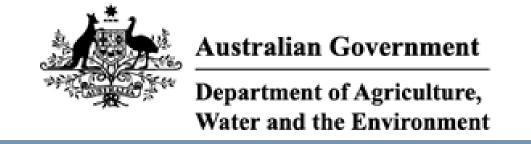
Other areas within the survey area that did not possess naturally occurring native vegetation or were void of vegetation were mapped separately. These areas, detailed below, occupied approximately 8 % (2,650 ha) of the survey area.

Areas where no vegetation occurred because of human disturbance were mapped as 'Cleared Land'; e.g. significant tracks and roads and open mining areas (approximately 1,300 ha, Figure 9). The numerous minor tracks throughout the survey area were not mapped as Cleared Land due to their complexity.

Portions of the North and South mine occurring within the survey area have been rehabilitated post-mining and were mapped as 'Rehabilitation Area' (approximately 1,325 ha, Figure 9).

Wetlands with obvious areas of open water, visible on aerial photography were mapped as 'Water' (approximately 23 ha, Figure 9).





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 <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/09/21 04:01:07

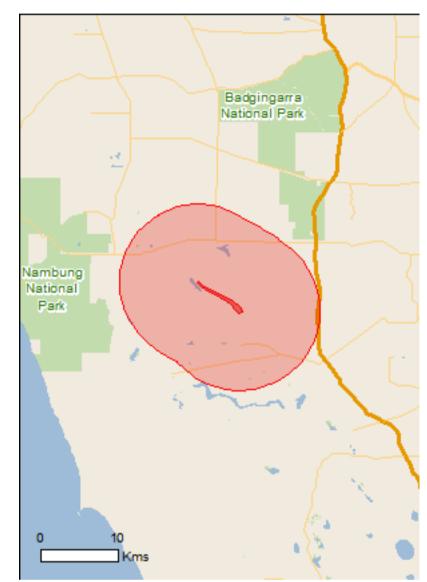
Summary

Details

Matters of NES
Other Matters Protected by the EPBC Act
Extra Information

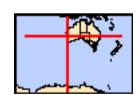
Caveat

<u>Acknowledgements</u>



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 10.0Km



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 <u>Administrative Guidelines on Significance</u>.

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:	24
Listed Migratory Species:	9

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 <u>permit</u> 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:	14
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:	4
Regional Forest Agreements:	None
Invasive Species:	14
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

Listed Threateried Leological Communities		<u>[INCOOURCE IIIIOIIIIAIIOII]</u>	
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.			
Name	Status	Type of Presence	
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	
Listed Threatened Species		[Resource Information]	
Name	Status	Type of Presence	
Birds			
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may 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	
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	
Mammals			
Bettongia penicillata ogilbyi			
Woylie [66844]	Endangered	Species or species habitat may occur within area	
Dasyurus geoffroii			
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area	
Parantechinus apicalis			
Dibbler [313]	Endangered	Species or species habitat may occur within area	
Plants			
Andersonia gracilis			
Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area	

[Resource Information]

Name	Status	Type of Presence
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat known to occur within area
Banksia catoglypta [85021]	Vulnerable	Species or species habitat likely to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
<u>Drakaea elastica</u> Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	Species or species habitat likely to occur within area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat likely to occur within area
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat likely to occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat may occur within area
Ptychosema pusillum Dwarf Pea [11268]	Vulnerable	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Listed Migratory Species * Species is listed under a different scientific name on	the EPBC Act - Threatened	[Resource Information] I Species list.
Name Migratory Marine Birds	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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 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
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 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	
Chrysococcyx osculans			
Black-eared Cuckoo [705]		Species or species habitat known to occur within area	
Haliaeetus leucogaster			
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur	

	Type of Presence
Name Threatened	• •
	within area
Merops ornatus	
Rainbow Bee-eater [670]	Species or species habitat
	may occur within area
Motacilla cinerea	
Grey Wagtail [642]	Species or species habitat
	may occur within area
Numanius madagasariansis	
Numenius madagascariensis	0,000
Eastern Curlew, Far Eastern Curlew [847] Critically Endange	·
	may occur within area
Pandion haliaetus	
	Species or species habitat
Osprey [952]	Species or species habitat may occur within area
	may occur within area
Rostratula benghalensis (sensu lato)	
Painted Snipe [889] Endangered*	Species or species habitat
r amitod empe [eee]	likely to occur within area
	mely to occur mum area
Tringa nebularia	
Common Greenshank, Greenshank [832]	Species or species habitat
	likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Badgingarra	WA
Unnamed WA40916	WA
Unnamed WA41986	WA
Wongonderrah	WA

Invasive Species [Resource Information]

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

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

Name	Status	Type of Presence
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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist' Smilax, Smilax Asparagus [22473]	's	Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Olea europaea		
Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780])	Species or species habitat may occur within area
Nationally Important Wetlands		[Resource Information]

Name

Lancelin Defence Training Area

State

WA

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 gualifications 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

-30.597592 115.32507,-30.597075 115.3261,-30.602099 115.333396,-30.604906 115.341121,-30.610668 115.354939,-30.615691 115.36481,-30.622708 115.375281,-30.626549 115.377427,-30.628026 115.373565,-30.627657 115.371161,-30.624259 115.368072,-30.621526 115.366956,-30.619163 115.36378,-30.615913 115.358373,-30.612145 115.351592,-30.608526 115.343781,-30.604167 115.334254,-30.600547 115.328418,-30.597592 115.325156,-30.597592 115.32507

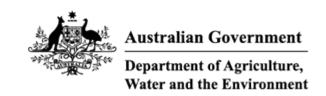
Acknowledgements

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.



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 30-Sep-2022

Summary

Details

Matters of NES
Other Matters Protected by the EPBC Act
Extra Information

Caveat

Acknowledgements

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	30
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	1
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	15
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[Resource Information]

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

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

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occu within area	ırln feature area

Listed Threatened Species

[Resource Information]

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

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Zanda latirostris listed as Calyptorhynchu Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	<u>us latirostris</u> Endangered	Breeding known to occur within area	In feature area
MAMMAL			
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In feature area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat may occur within area	In feature area
PLANT Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area	In feature area
Anigozanthos viridis subsp. terraspectan Dwarf Green Kangaroo Paw [3435]	<u>s</u> Vulnerable	Species or species habitat known to occur within area	In feature area
Banksia catoglypta [85021]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Caleana dixonii listed as Paracaleana dix Sandplain Duck Orchid [87944]	<u>konii</u> Endangered	Species or species habitat known to occur within area	In feature area
Chamelaucium sp. Gingin (N.G.Marchan Gingin Wax [88881]	<u>t 6)</u> Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Drakaea elastica	Tilleateried Category	FIESCILE TEXT	Dullet Status
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area	In feature area
Eucalyptus dolorosa Dandaragan Mallee, Mount Misery Mallee [56709]	Endangered	Species or species habitat may occur within area	In buffer area only
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area	In buffer area only
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat likely to occur within area	
Grevillea calliantha Foote's Grevillea, Cataby Grevillea, Black Magic Grevillea [56339]	Endangered	Species or species habitat may occur within area	In buffer area only
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within area	In feature area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area	In feature area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat known to occur within area	In feature area
Ptychosema pusillum Dwarf Pea [11268]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area	In feature area
REPTILE			
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Listed Migratory Species		[Re:	source Information 1
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

[Resource Information]

Other Matters Protected by the EPBC Act

Commonwealth Heritage Places

Name	State	Status	Buffer Status
Natural			
Lancelin Defence Training Area	WA	Listed place	In buffer area only
Listed Marine Species		[Re	source Information
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osc Black-eared Cuckoo [83425]	<u>culans</u>	Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula bengha Australian Painted Snipe [77037]	alensis (sensu lato) Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only

Extra Information					
State and Territory Reserves				[Resou	rce Information]
Protected Area Name	Reserve ⁻	Гуре	State	Bu	ffer Status
Badgingarra	National F	Park	WA	In	buffer area only
Nambung	National F	Park	WA	In	buffer area only
Unnamed WA40916	Nature Re	eserve	WA	In	buffer area only
Unnamed WA41986	Conserva	tion Park	WA In		buffer area only
Wongonderrah	Nature Re	eserve	WA Ir		buffer area only
Nationally Important Wetlands				[Resou	rce Information 1
Wetland Name			State		ffer Status
Lancelin Defence Training Area			WA		buffer area only
EPBC Act Referrals				<u> L Resou</u>	rce Information]
Title of referral Controlled action	Reference	Referral Outco	ome Assessme	nt Status	Buffer Status
Atlas Mineral Sands Mine	2020/8813	Controlled Act	ion Completed	t	In buffer area only
Atlas Mineral Sands Project	2021/9056	Controlled Act	ion Assessme	ent	In buffer area

EPBC Act Referrals			[Resou	<u>rce Information]</u>
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Atlas Mineral Sands Mine	2020/8813	Controlled Action	Completed	In buffer area only
Atlas Mineral Sands Project	2021/9056	Controlled Action	Assessment Approach	In buffer area only
Brand Highway Widening and Passing Lanes Project 34.83-164.3 SLK	2017/7864	Controlled Action	Post-Approval	In buffer area only
Cooljarloo West Titanium Minerals mining Project, WA	2013/6895	Controlled Action	Proposed Decision	In feature area
Not controlled action				
Cooljarloo Mine Falcon Extension	2007/3556	Not Controlled Action	Completed	In feature area
Cooljarloo Titanium Sand Mining	2000/23	Not Controlled Action	Completed	In buffer area only
Development of the Dandaragan Wind Farms	2011/6006	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Waddi Wind and Solar Farm, near Dandaragan, WA	2018/8352	Not Controlled Action	Completed	In buffer area only
Walyering 3D Seismic Survey, Cataby, WA	2017/7982	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manne	er)			
Mineral Sands Mine	2005/2001	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Transmission Line Rebuild and Extension	2009/5105	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
UIL Energy 2D Seismic Survey, Perth Basin, WA	2015/7554	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Raven 2D Seismic Acquisition Survey	2020/8659	Referral Decision	Referral Publication	In feature area
Transmission Line Rebuild and Extension	2009/4972	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

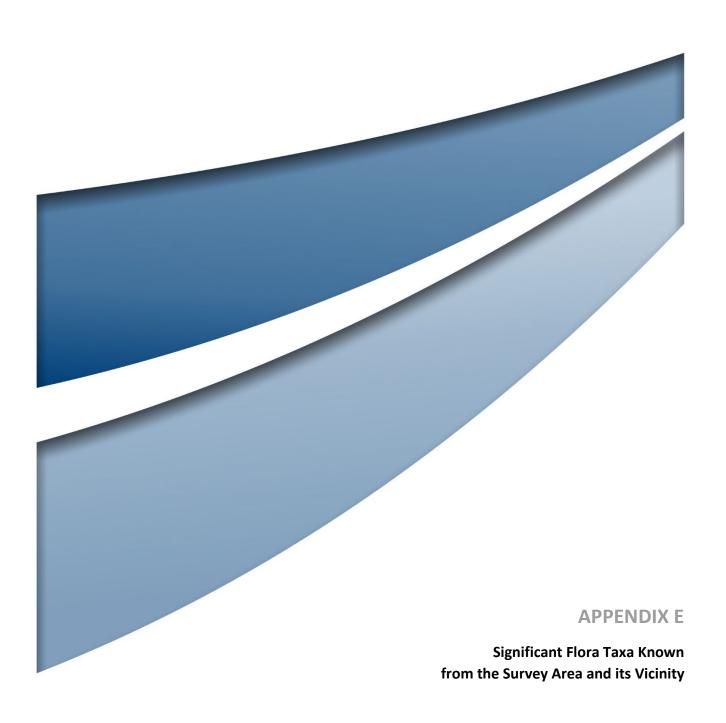
- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource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

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

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

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Note: taxa shaded in blue have known records within the Survey Area, and taxa shaded in grey were returned from the interrogation of the DCCEEW SPRAT Database but have not been previously recorded in the area according to DBCA databases (DBCA, 2021b, 2022a).

Symbols and sources are defined at the end of this appendix.

Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Acacia benthamii	P2		August to October	Flats and plains, sand dunes, seasonal wetlands with grey or brown sand, often over limestone. Limestone breakaways	NM
Allocasuarina grevilleoides	Р3		September to November	Slopes, outcrops and plains with rocky or gravelly brown sand or clay loam over laterite or granite	Iluka Mattiske NM WA Herb WEC
Andersonia gracilis	Т	EN	August to November	Winter-wet areas, near swamps with white-grey sand, sandy clay and gravelly loam	DCCEEW# Iluka Mattiske NM Rehab Strategen TPFL WA Herb WEC
Angianthus micropodioides	P3		September to January	Winter-wet areas, shallow depressions, clay pans, subsaline flats and dunes adjacent to salt lakes with grey or brown clay loam or sand	360 Iluka Mattiske NM WA Herb WEC
Anigozanthos humilis subsp. Badgingarra (S.D. Hopper 7114)	P2		September to December	Slopes, plains, flats and winterwet areas with white or grey sand. Banksia woodland, low wet heath	Outback
Anigozanthos humilis subsp. chrysanthus	P4		August to November	Slopes, plains and winter-wet areas with white, grey or yellow sand. Banksia woodland, low wet heath	Iluka Mattiske NM Strategen Umwelt WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Anigozanthos viridis subsp. terraspectans	Т	VU	October to November	Winter-wet flats, wetlands and basins with brown or yellow sand or clay loam. Recently burnt areas	DCCEEW# Iluka Mattiske NM Rehab Strategen TPFL Umwelt WA Herb WEC
Arnocrinum gracillimum	P3		October to January	Lower slopes and plains with white or grey sand over laterite, sometimes gravelly	NM Outback Rehab TPFL Umwelt WA Herb WEC
Babingtonia aff. cherticola	Potentially undescribed		November to December	Sandplains, slopes and flats with brown or grey sand, sometimes gravelly and over laterite. Low wet heath	Iluka Mattiske WEC
Babingtonia delicata	P1		November	Winter-wet closed depressions, wetlands and lakes with white, yellow or grey clayey sand	360 NM WEC
Babingtonia urbana	P3		December to March	Winter-wet depressions, flats and swamps with brown or white clay loam, sometimes peaty. Low wet heath	Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC
Banksia catoglypta	Т	VU	June	Slopes and breakaways with grey or white gravelly sand over laterite	DCCEEW~
Banksia dallanneyi subsp. pollosta	P3		August to September	Flats and slopes with grey or yellow sand with laterite or limestone	Astron Iluka Mattiske Strategen WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Beaufortia bicolor	P3		November to December	Upland areas with sandy soils over laterite	Iluka Mattiske NM TPFL Umwelt WA Herb WEC
Beaufortia eriocephala	P3		June, September to December	Ridges, low rises and flats with brown, grey or white sand or sandy clay and lateritic gravel over laterite or sometimes granite	360 Iluka Mattiske NM WA Herb WEC
Beyeria cinerea subsp. cinerea	P3		May to October	Slopes and hilltops with brown or grey calcareous sand over limestone	Iluka Mattiske WEC
Beyeria gardneri	Р3		August to September	Sandplains and hillsides with yellow sand, often over laterite	NM Rehab WA Herb
Byblis gigantea	P3		October to January	Low plains, flats and swamps with brown or white sand or sandy clay, sometimes peaty	NM WA Herb WEC
Caladenia denticulata subsp. albicans	P1		August to September	Near-coastal calcareous sandy soils under tall Acacia species	NM Umwelt WA Herb
Calectasia palustris	P2		September to November	Winter-wet flats and swamps with white sand	Iluka Mattiske NM TPFL WA Herb WEC
Calytrix aff. eneabbensis	Potentially undescribed		-	-	Mattiske NM WEC
Chamelaucium Iullfitzii	Т	EN	September to December	Hilltops, slopes and undulating plains with gravelly sand	DCCEEW^
Chordifex reseminans	P2		March to May	Flats and winter-wet depressions with white-grey sand over laterite	Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^S	Source*
Comesperma rhadinocarpum	P2		October to November	Undulating plains, valley slopes and flats with grey, brown or yellow sandy loam or sand	Rehab Umwelt WEC
Conospermum scaposum	P3		September to February	Winter-wet flats and depressions with white, brown or grey sand	360 Astron Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC
Conostephium magnum	P4		July to September	Sand dunes and slopes with white-grey sand	360 Iluka Mattiske NM Outback Rehab Strategen Umwelt WA Herb WEC
Desmocladus biformis	Р3		September to October	Hills, slopes and undulating plains with white or brown sand or sandy clay over laterite	Iluka Mattiske NM WA Herb WEC
Desmocladus elongatus	P4		August to December	Slopes, plains and uplands with white or grey sand over laterite	NM
Desmocladus nodatus	P3		October to January	Winter-wet flats, wetlands and edges of wetlands with white, grey or brown sandy clay	360 Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC
Drakaea elastica	Т	EN	October to November	Low plains and flats with grey or white sand	DCCEEW^
Drosera leioblastus	P1		September to October	White siliceous sand with laterite	NM WA Herb
Drosera leucostigma	P1		November	Sandy margins of winter-wet areas	NM WA Herb



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ⁵	Source*
Drosera prophylla	P3		June to July	Hilltops, lateritic breakaways, ridges and slopes with gravelly sand over laterite	NM TPFL WA Herb
Eremophila glabra subsp. chlorella	Т	EN	July to November	Winter-wet depressions, lake edges and flats with grey-white sandy clay or sand	NM WA Herb WEC
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	Р3		September to November	Winter-wet flats and depressions and clay pans, sometimes inundated, with grey or brown clay or sandy clay	Astron Iluka Mattiske WEC
Eucalyptus abdita	P2		February	Slopes and breakaways with laterite, sandy clay with gravel over laterite	NM
Eucalyptus × balanites	Т	EN	February, June to July	Slopes and plains with white, brown or grey sand or sandy loam, sometimes gravelly and over laterite	DCCEEW^
Eucalyptus dolorosa	Т	EN	February	Lateritic slopes and breakaways with gravelly/rocky brown loam	DCCEEW^
Eucalyptus leprophloia	Т	EN	July, November	Laterite breakaways with grey or white sand or sandy clay	DCCEEW~
Eucalyptus macrocarpa subsp. elachantha	P4		August to December	Hillslopes, ridges, sandplains with white or grey sand over laterite	360 Iluka NM Rehab TPFL WA Herb WEC
Eucalyptus pendens	P4		August to October	Breakaways and slopes with white, yellow or brown gravelly sand or sandy loam over laterite	NM TPFL WA Herb
Frankenia glomerata	P4		November	Salt lake edges, watercourses and flats with white sand or greybrown sandy loam	Iluka Mattiske WEC
Grevillea batrachioides	Т	EN	October to November	Slopes, plains and sandstone outcrops with brown gravelly sandy loam over sandstone	DCCEEW~
Grevillea calliantha	Т	EN	April, August to October	Plains and lower slopes with sandy loam over laterite or occasionally ironstone	DCCEEW^



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Grevillea cooljarloo	P1		September to November	Low flats and winter-wet areas with grey or white sand or sandy clay	360 Iluka Mattiske NM Rehab Umwelt WA Herb WEC
Grevillea saccata	P4		April or June to November	Hilltops and slopes with yellow or brown sand, usually with gravel and over laterite	Iluka NM Rehab TPFL WA Herb WEC
Guichenotia alba	P3		July to August	Flats and lower slopes with white or grey sand or clay with gravel over laterite	Iluka Mattiske NM Strategen WA Herb WEC
Hakea longiflora	Р3		June to July	High in landscape; hills, breakaways and plains with white, grey or yellow gravelly sand or sandy loam over laterite or occasionally sandstone	Iluka Mattiske Strategen WEC
Hakea megalosperma	Т	VU	April to June	High in landscape; hills, breakaways, slopes and flats with white, grey or brown sand or sandy loam over laterite	DCCEEW~ NM
Haloragis foliosa	P3		December	Dunes, interdunal swales and open depressions with white, brown or grey sand or clay loam over limestone	WEC
Hemiandra gardneri	Т	EN	August to November	Plains with yellow or grey sand or clayey sand	DCCEEW^
Hensmania stoniella	P3		September to November	Sandplains, flats and slopes with white, grey or lateritic sand	360 Iluka Mattiske NM Rehab Umwelt WA Herb WEC
Hibbertia leptotheca	P3		August to September	Slopes, dunes and limestone ridges and outcrops with white, grey or brown calcareous sand over limestone	Mattiske WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Hopkinsia anoectocolea	Р3		September to December	Winter-wet depressions, floodplains, salt lakes with white or grey sand, often saline	NM Rehab WA Herb
Hypocalymma gardneri	Р3		August to September	Sandplains, upper slopes and heathland with grey-brown sand and laterite	Iluka Mattiske WEC
Hypocalymma ×proliferum	P1		August	Slopes and plains with yellow, grey or brown sand. Margins of watercourses	WEC
Hypocalymma serrulatum	P2		April to July, November, January	Drainage lines, edges of and slopes above winter-wet depressions with grey sand	NM TPFL WA Herb WEC
Hypocalymma quadrangulare	P3		July to September	Lower slopes with grey or yellow sand, Banksia woodland	NM WEC
Hypocalymma tetrapterum	P3		July to September	Slopes above and edges of drainage lines with brown or grey sandy loam and lateritic gravel. Often in open eucalypt woodlands	NM TPFL
Hypolaena robusta	P4		September to November	Lateritic hills, plains and flats with white or grey sand and lateritic gravel over laterite, Banksia or <i>Eucalyptus todtiana</i> woodland	NM WEC
Isopogon autumnalis	Р3		April to June	Slopes, sandplains and flats with white, yellow or grey sand. Banksia woodland, upland areas	NM WA Herb
Isopogon panduratus subsp. palustris	P3		August to November	Low flats and winter-wet areas with sand or sandy clay	360 Astron Iluka Mattiske NM Rehab Strategen Umwelt WA Herb
Isotropis cuneifolia subsp. glabra	P3		August to October	Low rises and winter-wet depressions and flats with grey or brown sand or clay	Iluka Mattiske NM Strategen Umwelt WA Herb
Jacksonia anthoclada	P3		November	Slopes with brown, yellow or white sand over laterite, upland areas	NM TPFL WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ⁵	Source*
Jacksonia carduacea	Р3		July, November to December	Plains and flats with white, grey or yellow sand, sometimes over laterite	Iluka Mattiske NM Rehab WA Herb WEC
Lepidobolus densus	P4		August	Sandplains, lake edges and slopes with brown or yellow sand	WEC
Lepidobolus quadratus	Р3		August to September	Dry kwongan, hillslopes and rises with grey-white sand and lateritic gravel, upland areas	NM Outback
Lepyrodia curvescens	P2		September to November	Plains, winter wet flats, depressions and edges of wetlands with grey sandy loam	Iluka Mattiske NM Umwelt WA Herb WEC
Leucopogon sp. Yanchep (M. Hislop 1986)	Р3		April to June	Crests of low rises and plains, often coastal, with yellow, brown or grey sand over limestone. Banksia woodland	Iluka Mattiske NM WA Herb WEC
Levenhookia preissii	P1		October to January	Winter-wet flats and wetlands with grey or brown sand	NM Rehab Umwelt WA Herb WEC
Loxocarya gigas	P2		October to February	Lateritic breakaways, ridges, slopes and flats with white or grey sand over laterite	WEC
Lyginia excelsa	P1		September to October	Slopes, undulating plains and open depressions with white or grey sandy loam	360 Iluka Mattiske NM WA Herb WEC
Macarthuria keigheryi	Т	EN	September to October	Dunes, plains and low rises above winter-wet areas with white, brown or grey sand or clay loam. Banksia woodland, recently burnt areas	DCCEEW# Iluka Mattiske NM Rehab Strategen TPFL Umwelt WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Meionectes tenuifolia	P3		October to December	Inundated alluvial, granitic and winter-wet flats and wetlands with grey or brown sandy loam	TPFL WA Herb WEC
Myriophyllum muelleri	P1		November	Inundated winter-wet depressions	NM WA Herb
Paracaleana dixonii	T	EN	October to January	Undulating plains, flats and slopes with gravelly grey sand	Astron DCCEEW# Iluka Mattiske NM TPFL WA Herb WEC
Persoonia filiformis	P3		November to December	Sandplains with yellow or white sand over laterite	NM WA Herb
Persoonia rudis	Р3		September to January	Sandplains and flats with white, grey or yellow sand, often over laterite	Iluka Mattiske NM WA Herb WEC
Phlebocarya pilosissima subsp. pilosissima	Р3		August to October	Upland areas with white or grey sand with lateritic gravel	Iluka NM WA Herb WEC
Platysace ramosissima	Р3		October to November	Undulating plains and flats with yellow, brown or grey sand	Iluka Mattiske WEC
Poranthera asybosca	P1		September to October	White sand over laterite	NM Umwelt
Poranthera moorokatta	P2		September to November	White or grey sand	NM Rehab Umwelt
Ptychosema pusillum	Т	VU	September to October	Low plains, slopes and dunes with white or grey sand. Banksia woodland	DCCEEW^
Schoenus badius	P2		September to October	Slopes, drainage lines and winterwet flats with grey or brown sand	360 NM WA Herb
Schoenus griffinianus	P4		September to October	Sandplains and flats with white- grey sand	Iluka Mattiske NM Rehab Umwelt WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Schoenus natans	P4		September to December	Inundated winter-wet wetlands, clay pans and drainage lines with brown or grey clay, sometimes with lateritic gravel	Mattiske NM WEC
Schoenus pennisetis	P3		October to December	Winter-wet flats, wetlands and valley floors with grey, yellow or brown sandy loam	Iluka Mattiske NM Rehab Umwelt WA Herb WEC
Stenanthemum sublineare	P2		October to December	Slopes and flats with grey or brown sandy loam	Iluka Mattiske NM Rehab WA Herb WEC
Stylidium aceratum	P3		October to November	Winter-wet flats, swamps and wetlands with grey or brown sandy loam	360 Iluka Mattiske NM WA Herb WEC
Stylidium aeonioides	P4		September to November	Breakaways, slopes and flats with grey gravelly sand or clayey sand over laterite	Iluka NM Outback TPFL WA Herb
Stylidium carnosum subsp. ?Narrow leaves (J.A. Wege 490)	P1		September to October	Lateritic hillslopes and plains with white-grey sand	WEC
Stylidium hymenocraspedum	P3		September to October	White or grey sand on plains and slopes	Astron Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Stylidium longitubum	P4		July, October to December	Winter-wet damplands, flats and wetlands with brown or grey clay loam	360 Iluka Mattiske NM WA Herb WEC
Stylidium maritimum	P3		September to November	Dune slopes and flats, coastal heath and shrubland, open Banksia woodland with sand over limestone	NM WEC
Stylidium tinkeri	P1		April, October to November	Winter-wet depressions, flats, wetlands and valleys with brown or grey clay loam	NM WA Herb
Stylidium torticarpum	P3		September to November	Adjacent to drainage lines, depressions, and beneath breakaways, heath or mallee shrubland on sandy clay or clay loam over laterite	NM WA Herb
Styphelia obtecta	Т	EN	October to November	Plains with white, grey or yellow sand	DCCEEW^
Tetratheca angulata	P3		September to December	Slopes and hilltops with white, grey or brown gravelly sand or loam over laterite, bases of ridges and breakaways	NM Outback WEC
Thelymitra apiculata	P4		June to August	Slopes with grey or brown sand with lateritic gravel	Iluka Mattiske NM WA Herb
Thelymitra pulcherrima	P2		July to September	Flats and slopes of lateritic hills with white-grey sand or grey- brown sandy clay	Iluka Mattiske NM WA Herb
Thelymitra stellata	Т	EN	October to November	Ridges and tops of lateritic hills with grey or brown sand or loam and lateritic gravel	DCCEEW^ NM TPFL
Thysanotus glaucus	P4		October to January	Plains and slopes with white, grey or yellow sand or sandy gravel	Iluka Mattiske NM TPFL Rehab WA Herb WEC
Verticordia amphigia	P3		October to November	Winter-wet depressions with sandy loam, clay and rocky loam, ferricrete	NM WA Herb WEC



Taxon	Status (WA)	Status (EPBC)	Flowering Period ^{\$}	Habitat ^{\$}	Source*
Verticordia huegelii var. tridens	Р3		September to November	Slopes and gullies with brown or cream clay loam, over laterite or sometimes granite or spongolite	NM Strategen WA Herb WEC
Verticordia lindleyi subsp. lindleyi	P4		October to May	Plains, winter-wet depressions and flats with white, brown or grey sand	Iluka Mattiske NM Rehab Strategen Umwelt WA Herb WEC

EN = Endangered; VU = Vulnerable.

* Sources are:

360: 360 Environmental (2012, 2017a, 2017b)

Astron: Astron (2012, 2013)

DCCEEW: Interrogation of DCCEEW SPRAT Database (DAWE, 2021, 2022)

Iluka: Tronox-Iluka Significant Flora Database (current at 16 June 2021) (Iluka, 2021)

Mattiske: Mattiske (2012, 2017)

NM: NatureMap, WA Herbarium Specimen and TPFL Databases (DBCA, 2022a, 2007-2021)

Outback: Outback Ecology (2014)

Rehab: Rehabilitation monitoring (Umwelt/Woodman Environmental, various sources, 2001-)

Strategen: Strategen (2020)

TPFL, WA Herb: Interrogation of DBCA WA Herbarium Specimen and TPFL Databases (DBCA, 2021b)

WEC: Woodman Environmental (2011, 2013, 2014a, 2014b, 2015a, 2015b, 2016, 2017a, 2018a, 2018b, 2018c, 2019, 2021)

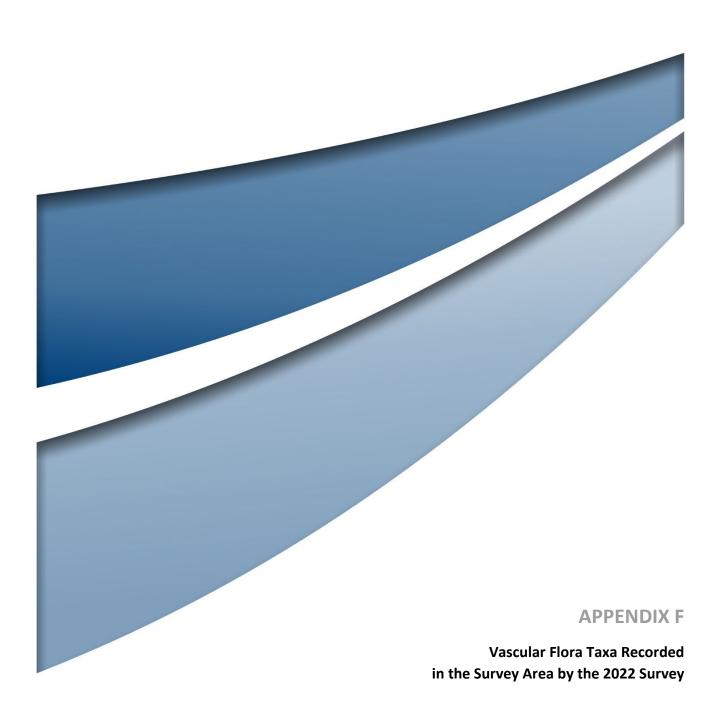
Umwelt: Umwelt (2022a, 2022b, 2023).

⁵ Source: Specimen information from specimens lodged at the WA Herbarium (accessed via Florabase) (WA Herbarium, 1998-).

[#] Species or species habitat known to occur within area (DAWE, 2021, 2022).

[~] Species or species habitat likely to occur within area (DAWE, 2021, 2022).

 $^{^{\}wedge}$ Species or species habitat may occur within area (DAWE, 2021, 2022).





Note: only taxa recorded in quadrats/relevés in the Survey Area by the Cooljarloo West survey that are considered additional to those recorded by the 2022 survey are indicated in the 'CLW' column.

Family	Taxon	2022	CLW
Aizoaceae	Carpobrotus virescens	Υ	
Amaranthaceae	Ptilotus manglesii	Υ	
	Ptilotus polystachyus	Υ	
Anarthriaceae	Anarthria grandiflora	Υ	
Anarthriaceae	Anarthria laevis	Υ	
	Lyginia barbata	Υ	
Apiaceae	Lyginia imberbis	Υ	
Apiaceae	Actinotus leucocephalus	Υ	
	Daucus glochidiatus	Υ	
	Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) (P3)		Υ
	Homalosciadium homalocarpum	Υ	
Araliaceae	Xanthosia huegelii	Υ	
Araliaceae	Hydrocotyle alata	Υ	
	Hydrocotyle callicarpa	Υ	
	Trachymene pilosa	Υ	
Asparagaceae	Laxmannia ramosa subsp. ramosa	Υ	
	Laxmannia sessiliflora subsp. ?australis		Υ
	Laxmannia sessiliflora subsp. sessiliflora	Υ	
	Lomandra hermaphrodita	Υ	
	Lomandra preissii		Υ
	Lomandra suaveolens	Υ	
	Sowerbaea laxiflora	Υ	
	Thysanotus dichotomus		Υ
	Thysanotus manglesianus	Υ	
	Thysanotus multiflorus		Υ
	Thysanotus patersonii	Υ	
	Thysanotus spiniger	Υ	
	Thysanotus thyrsoideus	Υ	
Asteraceae	?Angianthus tomentosus	Υ	
	*Arctotheca calendula	Υ	
	Blennospora drummondii	Υ	
	Brachyscome bellidioides	Υ	
	Brachyscome pusilla	Υ	
	Cotula cotuloides	Υ	
	Euchiton sphaericus	Υ	
	Gnephosis drummondii	Υ	
	Hyalosperma cotula	Υ	
	*Hypochaeris glabra	Υ	



Family	Taxon	2022	CLW
Asteraceae cont.	Millotia myosotidifolia	Υ	
	Olearia axillaris	Υ	
	Panaetia lessonii	Υ	
	Podolepis gracilis		Υ
	Podotheca angustifolia	Υ	
	Podotheca chrysantha	Υ	
	Podotheca gnaphalioides	Υ	
	Pogonolepis stricta		Υ
	Pterochaeta paniculata	Υ	
	Quinetia urvillei	Υ	
	Senecio pinnatifolius var. latilobus	Υ	
	Siloxerus humifusus	Υ	
	Siloxerus multiflorus	Υ	
	*Sonchus oleraceus	Υ	
	*Ursinia anthemoides subsp. anthemoides	Υ	
	Waitzia acuminata var. albicans	Υ	
	Waitzia nitida	Υ	
	Waitzia suaveolens var. suaveolens	Υ	
Boryaceae	Borya sphaerocephala	Υ	
Brassicaceae	*Heliophila pusilla	Υ	
Campanulaceae	Isotoma hypocrateriformis		Υ
	Lobelia rhytidosperma	Υ	
	*Wahlenbergia capensis	Υ	
	Wahlenbergia gracilenta		Υ
	Wahlenbergia preissii	Υ	
Caryophyllaceae	*Sagina apetala	Υ	
	Spergularia brevifolia	Υ	
Casuarinaceae	Allocasuarina humilis	Υ	
	Allocasuarina lehmanniana subsp. lehmanniana	Υ	
Celastraceae	Stackhousia monogyna		Υ
	Tripterococcus brunonis	Υ	
Centrolepidaceae	Aphelia cyperoides	Υ	
	Aphelia nutans	Υ	
	Centrolepis aristata	Υ	
	Centrolepis drummondiana	Υ	
	Centrolepis mutica	Υ	
	Centrolepis pilosa	Υ	
	Centrolepis polygyna	Υ	
Chenopodiaceae	Rhagodia baccata subsp. baccata	Υ	
	Tecticornia indica subsp. bidens		Υ



Family	Taxon	2022	CLW
Colchicaceae	Burchardia congesta	Υ	
	Burchardia multiflora	Υ	
	Wurmbea dioica subsp. alba	Υ	
Crassulaceae	Crassula closiana	Υ	
	Crassula colorata var. acuminata	Υ	
	Crassula exserta	Υ	
Cupressaceae	Callitris pyramidalis	Υ	
Cyperaceae	Caustis dioica	Υ	
	Chaetospora curvifolia	Υ	
	Cyathochaeta avenacea	Υ	
	*Ficinia marginata	Υ	
	Gahnia trifida	Υ	
	Lepidosperma apricola	Υ	
	Lepidosperma longitudinale	Υ	
	Lepidosperma cf. pubisquameum	Υ	
	Lepidosperma aff. scabrum		Υ
	Lepidosperma squamatum		Υ
	Mesomelaena pseudostygia	Υ	
	Schoenus brevisetis		Υ
	Schoenus clandestinus	Υ	
	Schoenus griffinianus (P4)	Υ	
	Schoenus odontocarpus	Υ	
	Schoenus ?pedicellatus		Υ
	Schoenus pleiostemoneus	Υ	
	Schoenus rigens	Υ	
	Schoenus subfascicularis	Υ	
	Schoenus subflavus	Υ	
Dasypogonaceae	Dasypogon obliquifolius	Υ	
Dilleniaceae	Hibbertia crassifolia	Υ	
	Hibbertia hypericoides subsp. hypericoides	Υ	
	Hibbertia pubens	Υ	
	Hibbertia racemosa	Υ	
	Hibbertia ?sericosepala		Υ
	Hibbertia stellaris	Υ	
	Hibbertia striata	Υ	
	Hibbertia subvaginata	Υ	
Droseraceae	Drosera drummondii	Υ	
	Drosera eneabba	Υ	
	Drosera erythrorhiza	Υ	
	Drosera gigantea	Υ	



Family	Taxon	2022	CLW
Droseraceae cont.	Drosera glanduligera	Υ	
	Drosera humilis	Υ	
	Drosera magna		Υ
	Drosera menziesii	Υ	
	Drosera minutiflora	Υ	
	Drosera thysanosepala	Υ	
Ericaceae	Conostephium pendulum	Υ	
	Conostephium preissii	Υ	
	Leucopogon oldfieldii	Υ	
	Leucopogon oliganthus	Υ	
	Leucopogon parviflorus		Υ
	Leucopogon sprengelioides		Υ
	Leucopogon stenophyllus		Υ
	Lysinema pentapetalum	Υ	
	Styphelia conostephioides	Υ	
	Styphelia glaucifolia	Υ	
	Styphelia microdonta		Υ
	Styphelia tortifolia	Υ	
•	Styphelia xerophylla	Υ	
Fabaceae	Acacia applanata	Υ	
	Acacia cyclops	Υ	
	Acacia dilatata	Υ	
	Acacia lasiocarpa var. lasiocarpa	Υ	
	Acacia pulchella var. glaberrima	Υ	
	Acacia pulchella var. pulchella	Υ	
	Acacia pulchella var. reflexa		Υ
	Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602)	Υ	
	Acacia sphacelata subsp. verticillata		Υ
	Bossiaea eriocarpa	Υ	
	Daviesia decurrens subsp. decurrens	Υ	
	Daviesia divaricata subsp. divaricata	Υ	
	Daviesia incrassata subsp. incrassata	Υ	
	Daviesia incrassata subsp. teres	Υ	
	Gompholobium tomentosum	Υ	
	Hovea pungens	Υ	
	Isotropis cuneifolia subsp. cuneifolia	Υ	
	Jacksonia floribunda	Υ	
	Jacksonia hakeoides	Υ	
	Jacksonia nutans	Υ	
	Jacksonia sternbergiana	Υ	



Family	Taxon	2022	CLW
Fabaceae cont.	Kennedia prostrata	Υ	
	Mirbelia ?spinosa		Υ
	*Ornithopus compressus	Υ	
	*Ornithopus sativus	Υ	
	*Trifolium arvense var. arvense	Υ	
	Viminaria juncea	Υ	
Frankeniaceae	Frankenia pauciflora		Υ
Gentianaceae	*Cicendia filiformis	Υ	
	Schenkia ?australis		Υ
Goodeniaceae	Dampiera lindleyi	Υ	
	Dampiera linearis	Υ	
	Dampiera spicigera		Υ
	Dampiera teres	Υ	
	Goodenia coerulea	Υ	
	Goodenia micrantha	Υ	
	Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)	Υ	
	Goodenia reinwardtii		Υ
	Goodenia trinervis	Υ	
	Lechenaultia linarioides	Υ	
	Lechenaultia stenosepala	Υ	
	Scaevola anchusifolia	Υ	
	Scaevola canescens		Υ
	Scaevola ?lanceolata		Υ
	Scaevola repens var. repens	Υ	
Gyrostemonaceae	Gyrostemon subnudus	Υ	
Haemodoraceae	Anigozanthos humilis subsp. humilis	Υ	
	Anigozanthos pulcherrimus	Υ	
	Anigozanthos viridis subsp. Cataby (S.D. Hopper 1786)	Υ	
	Anigozanthos viridis subsp. terraspectans (T)	Υ	
	Blancoa canescens	Υ	
	Conostylis ?aculeata subsp. aculeata		Υ
	Conostylis aculeata subsp. breviflora	Υ	
	Conostylis aculeata subsp. spinuligera	Υ	
	Conostylis angustifolia	Υ	
	Conostylis aurea		Υ
	Conostylis crassinerva subsp. absens	Υ	
	Conostylis juncea	Υ	
	Conostylis prolifera	Υ	
	Conostylis teretifolia subsp. teretifolia	Υ	
	Haemodorum simplex	Υ	



Family	Taxon	2022	CLW
Haemodoraceae	Haemodorum spicatum	Υ	
cont.	Phlebocarya ciliata	Υ	
	Phlebocarya filifolia	Υ	
	Tribonanthes australis	Υ	
	Tribonanthes variabilis	Υ	
Haloragaceae	Glischrocaryon aureum		Υ
	Gonocarpus nodulosus	Υ	
	Gonocarpus pithyoides	Υ	
Hemerocallidaceae	Arnocrinum preissii		Υ
	Chamaescilla versicolor	Υ	
	Corynotheca micrantha	Υ	
	Johnsonia pubescens subsp. pubescens	Υ	
	Tricoryne elatior	Υ	
Iridaceae	*Gladiolus caryophyllaceus	Υ	
	Orthrosanthus laxus var. laxus	Υ	
	Patersonia occidentalis var. occidentalis	Υ	
Juncaceae	*Juncus capitatus	Υ	
Juncaginaceae	Triglochin nana	Υ	
Lamiaceae	Hemiandra linearis		Υ
	Hemiandra pungens	Υ	
	Hemiphora bartlingii	Υ	
	Quoya verbascina	Υ	
Lauraceae	Cassytha aurea var. hirta	Υ	
	Cassytha flava	Υ	
	Cassytha glabella forma bicallosa		Υ
	Cassytha glabella forma casuarinae	Υ	
	Cassytha glabella forma dispar		Υ
	Cassytha racemosa forma pilosa	Υ	
	Cassytha racemosa forma racemosa	Υ	
Lentibulariaceae	Utricularia multifida	Υ	
Loganiaceae	Orianthera spermacocea		Υ
	Phyllangium divergens	Υ	
Loranthaceae	Nuytsia floribunda	Υ	
Macarthuriaceae	Macarthuria apetala		Υ
	Macarthuria australis	Υ	
Malvaceae	Lasiopetalum lineare		Υ
Montiaceae	Calandrinia corrigioloides	Υ	
	Calandrinia granulifera	Υ	
	Calandrinia sp. Kenwick (G.J. Keighery 10905)	Υ	



Family	Taxon	2022	CLW
Myrtaceae	Apectospermum spinescens	Υ	
	Babingtonia urbana (P3)	Υ	
	Beaufortia elegans	Y	
	Beaufortia squarrosa	Υ	
	Calothamnus hirsutus	Y	
	Calothamnus quadrifidus subsp. angustifolius	Υ	
	Calothamnus quadrifidus subsp. quadrifidus		Υ
	Calytrix aurea	Υ	
	Calytrix flavescens	Υ	
	Calytrix fraseri	Υ	
	Chamelaucium uncinatum	Y	
	Darwinia pinifolia	Υ	
	Eremaea asterocarpa subsp. asterocarpa	Y	
	Eremaea beaufortioides var. beaufortioides	Υ	
	Eremaea pauciflora var. lonchophylla	Υ	
	Eremaea pauciflora var. pauciflora	Υ	
	Eucalyptus decipiens	Υ	
	Eucalyptus rudis subsp. rudis	Y	
	Eucalyptus todtiana	Y	
	Hypocalymma balbakiae	Υ	
	Hypocalymma quadrangulare (P3)	Y	
	Hypocalymma suave	Υ	
	Hypocalymma xanthopetalum	Υ	
	Kunzea micrantha subsp. petiolata	Υ	
	Leptospermopsis erubescens		Υ
	Melaleuca acutifolia	Y	
	Melaleuca brevifolia	Y	
	Melaleuca clavifolia	Y	
	Melaleuca incana subsp. incana	Υ	
	Melaleuca lateritia	Y	
	Melaleuca leuropoma		Υ
	Melaleuca preissiana	Y	
	Melaleuca rhaphiophylla	Y	
	Melaleuca seriata	Y	
	Melaleuca teretifolia	Y	
	Melaleuca viminea subsp. viminea	Y	
	Pericalymma ellipticum var. ellipticum	Y	
	Pericalymma ellipticum var. floridum	Y	
	Pericalymma spongiocaule	T T	Υ
	Pileanthus filifolius	Y	ſ



Family	Taxon	2022	CLW
Myrtaceae cont.	Regelia ciliata	Y	
	Scholtzia involucrata	Υ	
	Scholtzia parviflora	Υ	
Olacaceae Orchidaceae Orobanchaceae Philydraceae	Scholtzia sp. Wongonderrah (M.E. & M.R. Trudgen MET 12000)	Υ	
	Thryptomene hyporhytis	Υ	
	Verticordia ?blepharophylla		Υ
	Verticordia densiflora var. densiflora	Υ	
	Verticordia lindleyi subsp. lindleyi (P4)	Y	
	Verticordia pennigera		Υ
	Verticordia plumosa var. brachyphylla	Υ	
Olacaceae	Olax scalariformis	Y	
Orchidaceae	Caladenia flava subsp. flava	Υ	
	Caladenia longicauda subsp. albella	Y	
	Elythranthera brunonis	Y	
	?Microtis sp.		Υ
	?Paracaleana sp.	Υ	
	Pterostylis vittata	Y	
	Pyrorchis nigricans	Υ	
	Thelymitra vulgaris	Υ	
Orobanchaceae	*Orobanche minor	Y	
	*Parentucellia latifolia	Y	
Philydraceae	Philydrella pygmaea subsp. pygmaea	Υ	
Phyllanthaceae	Poranthera asybosca (P1)	Υ	
	Poranthera drummondii		Υ
	Poranthera microphylla	Υ	
Poaceae	Iraceae Philydrella pygmaea subsp. pygmaea Y Inthaceae Poranthera asybosca (P1) Y Poranthera drummondii Poranthera microphylla Y Paee *Aira caryophyllea subsp. caryophyllea Y		
	*Aira cupaniana	Υ	
	Amphipogon caricinus var. caricinus	Y	
	Amphipogon turbinatus	Υ	
	Austrostipa compressa	Y	
	Austrostipa macalpinei	Υ	
	*Avellinia festucoides	Υ	
	*Briza maxima	Υ	
	*Briza minor	Υ	
	*Ehrharta calycina	Υ	
	Neurachne alopecuroidea	Υ	
	*Pentameris airoides subsp. airoides	Υ	
	Polypogon tenellus		Υ
	Rytidosperma ?occidentale		Υ
	Rytidosperma setaceum	Y	



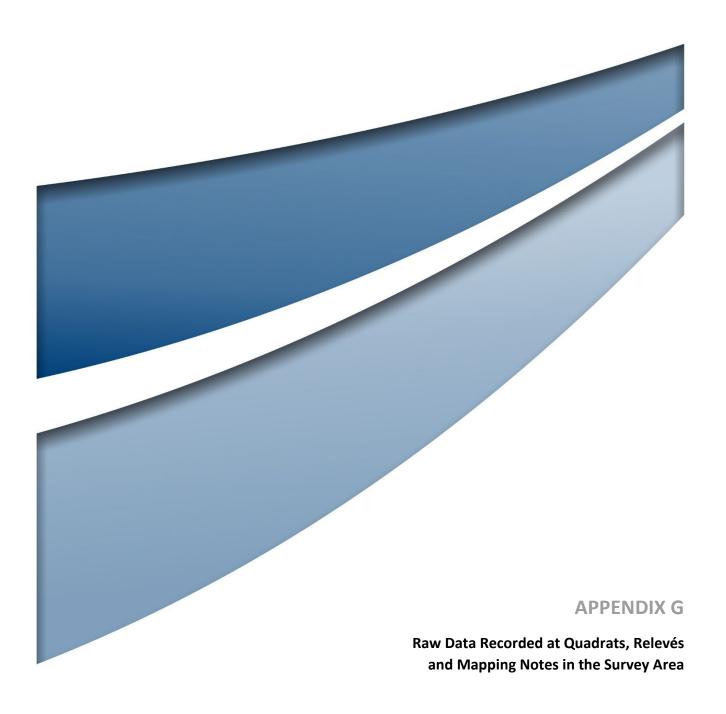
Family	Taxon	2022	CLW
Poaceae cont.	*Vulpia myuros forma myuros	Υ	
Polygalaceae	Comesperma calymega	Υ	
Primulaceae	*Lysimachia arvensis	Υ	
	Samolus junceus	Υ	
	Samolus repens		Υ
Proteaceae	Adenanthos cygnorum subsp. cygnorum	Υ	
	Banksia attenuata	Υ	
	Banksia dallanneyi subsp. dallanneyi var. dallanneyi		Υ
	Banksia ilicifolia		Υ
	Banksia littoralis	Υ	
	Banksia menziesii	Υ	
	Banksia nivea subsp. nivea	Υ	
	Banksia platycarpa	Υ	
	Banksia prionotes	Υ	
	Banksia sessilis var. cygnorum	Υ	
	Banksia telmatiaea	Υ	
	Conospermum scaposum (P3)	Υ	
	Conospermum stoechadis subsp. stoechadis	Υ	
	Conospermum teretifolium	Υ	
	Grevillea cooljarloo (P1)	Υ	
	Hakea costata	Υ	
	Hakea lissocarpha	Υ	
	Hakea obliqua subsp. parviflora	Υ	
	Hakea prostrata	Υ	
	Hakea ruscifolia		Υ
	Hakea sulcata	Υ	
	Hakea trifurcata	Υ	
	Hakea varia	Υ	
	Isopogon panduratus subsp. palustris (P3)	Υ	
	Persoonia comata	Υ	
	Persoonia rudis (P3)	Υ	
	Persoonia trinervis	Υ	
	Petrophile brevifolia sens. lat.	Υ	
	Petrophile linearis	Υ	
	Petrophile macrostachya	Υ	
	Petrophile recurva	Υ	
	Petrophile seminuda	Υ	
	Stirlingia abrotanoides	Υ	
	Stirlingia latifolia	Υ	
	Synaphea spinulosa subsp. spinulosa	Υ	



Family	Taxon	2022	CLW
Ranunculaceae	Clematis linearifolia	Υ	
Restionaceae	Alexgeorgea nitens	Υ	
	Alexgeorgea subterranea	Υ	
	Chaetanthus aristatus	Υ	
	Chordifex reseminans (P2)	Υ	
	Chordifex sinuosus	Υ	
	Desmocladus asper	Υ	
	Desmocladus ?flexuosus		Υ
	Desmocladus lateriflorus		Υ
	Desmocladus nodatus (P3)	Υ	
	Hypolaena pubescens	Υ	
	Lepidobolus preissianus subsp. preissianus	Υ	
	Leptocarpus canus	Υ	
	Lepyrodia curvescens (P2)	Υ	
Rhamnaceae	Cryptandra pungens	Υ	
Rubiaceae	*Galium murale	Υ	
	Opercularia vaginata	Υ	
Rutaceae	Cyanothamnus ramosus subsp. anethifolius	Υ	
	Philotheca spicata	Υ	
Santalaceae	Exocarpos sparteus	Υ	
Scrophulariaceae	Myoporum insulare	Υ	
Solanaceae	Anthocercis ilicifolia subsp. ilicifolia	Υ	
	Solanum symonii	Υ	
Stylidiaceae	Levenhookia pusilla	Υ	
	Levenhookia stipitata	Υ	
	Stylidium adpressum		Υ
	Stylidium androsaceum	Υ	
	Stylidium araeophyllum	Υ	
	Stylidium bicolor	Υ	
	Stylidium calcaratum	Υ	
	Stylidium crossocephalum	Υ	
	Stylidium cygnorum	Υ	
	Stylidium dichotomum	Υ	
	Stylidium diuroides subsp. diuroides	Υ	
	Stylidium diuroides subsp. paucifoliatum		Υ
	Stylidium divaricatum	Υ	
	Stylidium hymenocraspedum (P3)	Υ	
	Stylidium obtusatum	Υ	
	Stylidium perpusillum	Υ	
	Stylidium petiolare	Υ	



Family	Taxon	2022	CLW
Stylidiaceae cont.	Stylidium purpureum	Υ	
	Stylidium repens	Υ	
	Stylidium rigidulum	Υ	
	Stylidium spiciforme	Υ	
Thymelaeaceae	Pimelea imbricata var. piligera	Υ	
	Pimelea sulphurea	Υ	
Violaceae	Pigea calycina	Υ	
Xanthorrhoeaceae	Xanthorrhoea preissii	Υ	
Zamiaceae	Macrozamia fraseri	Υ	



GOVERNMENT AGENCY REFERENCE ONLY

NOT FOR PUBLIC DISSEMINATION

CONTAINS LOCATIONS OF SIGNIFICANT FLORA TAXA



QUADRATS

Site Name: LFGS01

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 342476.09E 6612441.73N

Orientation: 90/180

Community: W-B

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

0%

Aspect: SE

Soil Type: Sandy Loam

Soil Colour: Brown
Soil Condition: Moist

Rock Outcrop: No bedrock exposed

Nock outerop. No bearee

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: (other) - Low

Fire: >5 Years

Habitat: Mid sparse shrubland over low heathland.

SITE POINTS

CF Abundance:

Label	Easting	Northing	Comments
Corner 1	342479	6612431	SW Corner
Corner 2	342488	6612432	SE Corner
Corner 3	342485	6612443	NE Corner

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia dilatata	0.1	0.1
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Austrostipa compressa	0.2	0.1
Brachyscome pusilla	0.1	0.1
Calothamnus hirsutus	0.4	12
Calytrix flavescens	0.35	4
Centrolepis aristata	0.1	0.1
Conostylis prolifera	0.1	0.1
Drosera gigantea	0.35	0.1
Drosera glanduligera	0.1	0.1



Drosera menziesii	0.2	0.1
?Hakea ruscifolia	0.1	0.1
Hakea sulcata	0.4	0.5
*Hypochaeris glabra	0.1	0.1
Lomandra ?hermaphrodita	0.15	0.1
Melaleuca acutifolia	1.5	0.5
Melaleuca brevifolia		
Melaleuca seriata	0.4	8
Petrophile seminuda	0.8	0.8
Podotheca angustifolia	0.1	0.1
Regelia ciliata	0.3	8
Siloxerus humifusus		0.1
Stylidium dichotomum	0.15	0.1
Thysanotus manglesianus		0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.9	5

PHOTOS





Site Name: LFGS02

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 341776.1652E 6613083.035N

Orientation: 90/180

Community: W-B

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: S

Soil Type: Sandy Loam

Soil Colour: Grey

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low sparse shrubland over low heathland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341778	6613073	SW Corner
Corner 2	341788	6613074	SE Corner
Corner 3	341786	6613085	NE Corner

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia dilatata	0.2	0.1
*Aira caryophyllea subsp. caryophyllea	0.5	0.1
Aphelia nutans	0.03	0.1
Austrostipa compressa	0.2	0.1
Banksia telmatiaea	0.8	12
Calothamnus hirsutus	0.35	4
Calytrix flavescens	0.25	2
Centrolepis aristata	0.05	0.1
Conostylis aculeata subsp. spinuligera	0.4	0.1
Crassula closiana	0.03	0.1
Dampiera teres		
Drosera gigantea	0.25	0.1
Drosera glanduligera	0.05	0.1



Drosera menziesii	0.1	0.1
Hakea sulcata	0.4	2
Hibbertia crassifolia	0.4	5
Kunzea micrantha subsp. petiolata		
Lomandra ?hermaphrodita	0.1	0.1
Melaleuca seriata	0.45	8
Neurachne alopecuroidea	0.5	0.1
Patersonia occidentalis var. occidentalis	0.4	0.1
Petrophile seminuda	0.5	10
Philydrella pygmaea subsp. pygmaea	0.05	0.1
Pimelea imbricata var. piligera		
Podotheca angustifolia		
Ptilotus manglesii	0.12	0.1
Regelia ciliata	0.5	10
Scaevola anchusifolia	0.08	0.1
Schoenus subfascicularis	0.35	0.1
Siloxerus humifusus	0.2	0.1
Stylidium calcaratum	0.05	0.1
Stylidium dichotomum	0.1	0.1
Stylidium petiolare		
Styphelia glaucifolia	0.3	2
Thysanotus thyrsoideus	0.25	0.1
Tribonanthes variabilis	0.2	0.1
Verticordia densiflora var. densiflora	0.8	10
Verticordia plumosa var. brachyphylla	1	3









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339856.0133E 6613191.282N

Orientation: 90/180

Community: W-D

Landform Type: Plain/Open Depression

Slope Class: Very Gently Inclined (1 degree)

Aspect: E

Soil Type: Sandy Clay
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Animal Disturbance - Rabbits

Fire: >5 Years

Habitat: Tall sparse shrubland over mid shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339855	6613181	SW Corner
Corner 2	339865	6613180	SE Corner
Corner 3	339866	6613191	NE Corner

Taxon Name	Avg. Height	Cover Alive
*Aira caryophyllea subsp. caryophyllea		
Caladenia sp.	0.25	0.1
Cassytha racemosa		0.1
*Cicendia filiformis		
Crassula exserta	0.05	0.1
Drosera glanduligera	0.5	0.1
Euchiton sphaericus		
Goodenia micrantha		
*Hypochaeris glabra	0.1	0.1
Lysinema pentapetalum		
Melaleuca viminea subsp. viminea	1.5	55
*Orobanche minor		



Podotheca angustifolia	0.2	0.1
Regelia ciliata	1.5	4
Thysanotus manglesianus		0.1
Trachymene pilosa	0.08	0.1
*Ursinia anthemoides subsp. anthemoides		
*Vulpia myuros forma myuros	0.15	0.1









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339944.9E 6613457.02N

Orientation: 90/180

Community: W-C

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: NE

Soil Type: Loamy Sand Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

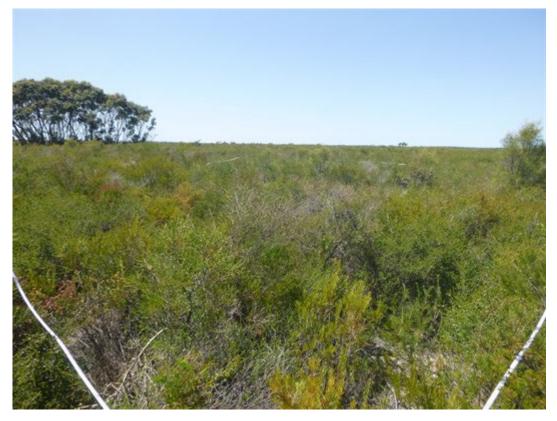
Habitat: Mid isolated heath shrubs over mid closed heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339947	6613448	SW Corner
Corner 2	339956	6613448	SE Corner
Corner 3	339956	6613458	NE Corner

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	1	2.5
Babingtonia urbana (P3)	0.4	1
Banksia telmatiaea	0.6	20
Cassytha racemosa		1
Conospermum stoechadis subsp. stoechadis	0.8	0.1
Conostylis aculeata subsp. spinuligera	0.35	0.1
Hakea obliqua subsp. parviflora	1.8	8
Hibbertia stellaris	0.15	1
Isopogon panduratus subsp. palustris (P3)	1.1	1
Jacksonia hakeoides	0.8	0.5
Melaleuca seriata	1	10
Podotheca angustifolia		0.1
Regelia ciliata	1.5	35
Verticordia densiflora var. densiflora	0.7	3









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339922.1701E 6613941.937N

Orientation: 90/180

Community: W-C

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: W

Soil Type: Loamy Sand
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid sparse heathland over low closed heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339923	6613934	SW Corner
Corner 2	339933	6613934	SE Corner
Corner 3	339933	6613943	NE Corner

Taxon Name	Avg. Height	Cover Alive
Acacia dilatata	0.1	0.1
Austrostipa compressa	0.2	0.1
Babingtonia urbana (P3)	0.6	2.5
Banksia nivea subsp. nivea	0.15	0.5
Banksia platycarpa	0.2	0.5
Banksia telmatiaea	0.8	17
Beaufortia squarrosa	0.5	3
Calytrix aurea	1.5	1
Calytrix flavescens	0.25	1.5
Conospermum stoechadis subsp. stoechadis	0.6	2
Conostylis aculeata subsp. spinuligera	0.25	0.1
Conostylis crassinerva subsp. absens		
Daviesia incrassata subsp. incrassata	0.55	0.1



Hakea obliqua subsp. parviflora	1.6	10
Hibbertia crassifolia	0.35	0.5
Hypocalymma balbakiae	0.3	1
Isopogon panduratus subsp. palustris (P3)	0.7	3
Jacksonia hakeoides	0.4	0.5
Lysinema pentapetalum	0.2	0.1
Melaleuca seriata	0.5	8
Petrophile brevifolia sens. lat.	0.25	5
Regelia ciliata	1	20
Stirlingia latifolia	0.3	0.5
Stylidium rigidulum	0.1	0.1
Verticordia densiflora var. densiflora	0.9	2









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340171.7463E 6613758.829N

Orientation: 90/180

Community: W-C

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid isolated heath shrubs over low heathland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340175	6613750	SW Corner
Corner 2	340183	6613752	SE Corner
Corner 3	340181	6613761	NE Corner

Taxon Name	Avg. Height	Cover Alive
Acacia dilatata	0.15	0.1
Acacia dilatata	0.15	0.1
Banksia nivea subsp. nivea	0.3	3
Banksia telmatiaea	0.9	13
Beaufortia squarrosa	0.45	1
Cassytha racemosa		0.1
Conostylis aculeata subsp. spinuligera	0.35	0.1
Crassula exserta	0.05	0.1
Hakea obliqua subsp. parviflora	1.5	5
Hakea varia		
Hibbertia stellaris	0.2	0.1
Hypocalymma balbakiae	0.25	0.5
Isopogon panduratus subsp. palustris (P3)	1	1
Melaleuca seriata	0.5	6



Petrophile brevifolia sens. lat.	0.35	0.1
Regelia ciliata	0.8	23
Siloxerus humifusus	0.01	0.1
Stylidium calcaratum	0.08	0.1
*Ursinia anthemoides subsp. anthemoides	0.2	0.1
Verticordia densiflora var. densiflora	0.8	2









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340556.24E 6613479.04N

Orientation: 90/180

Community: W-E

Landform Type: Undulating Plain
Slope Class: Level (0 degrees)

Soil Type: Sandy Clay

Soil Colour: Brown/Grey/Orange

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: 5-10 Years

Habitat: Mid open heathland over low sparse heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340560	6613469	SW Corner
Corner 2	340568	6613472	SE Corner
Corner 3	340568	6613482	NE Corner

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.15	0.1
Banksia platycarpa		
Banksia telmatiaea	1.1	25
Conospermum stoechadis subsp. stoechadis		
Drosera menziesii		
Eremaea asterocarpa subsp. asterocarpa		
Hakea obliqua subsp. parviflora		
Isopogon panduratus subsp. palustris (P3)		
Kunzea micrantha subsp. petiolata		
Melaleuca seriata		
Petrophile seminuda	0.6	0.5
Regelia ciliata		
Schoenus rigens	0.25	0.1
Schoenus subfascicularis	0.35	0.1









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340903.6546E 6612792.483N

Orientation: 90/180

Community: W-C

Landform Type: Undulating Plain/Open Depression

Slope Class: Level (0 degrees)

Soil Type: Sandy Clay
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall isolated heath shrubs over mid heathland over low open heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340903	6612783	SW Corner
Corner 2	340914	6612782	SE Corner
Corner 3	340914	6612792	NE Corner

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa		
Banksia nivea subsp. nivea	0.35	1
Banksia platycarpa		
Banksia telmatiaea	1.1	20
Cassytha racemosa		0.1
Chaetanthus aristatus	0.25	0.5
Conostylis aculeata subsp. spinuligera	0.3	0.1
Crassula exserta	0.5	0.1
Hakea obliqua subsp. parviflora	1.9	7
Hakea varia	0.3	0.5
Hibbertia stellaris	0.2	0.1
Hypolaena pubescens	0.15	0.1
Isopogon panduratus subsp. palustris (P3)	0.6	0.2
Melaleuca brevifolia	0.8	3



Melaleuca seriata	0.6	2
Pericalymma ellipticum var. floridum	0.7	0.2
Petrophile brevifolia sens. lat.	0.45	0.1
Petrophile seminuda	0.6	0.5
Regelia ciliata	1.2	10
Scaevola anchusifolia	0.1	0.1
Schoenus rigens	0.25	0.1
Siloxerus humifusus	1	0.1
Stirlingia latifolia		
*Ursinia anthemoides subsp. anthemoides		
Verticordia densiflora var. densiflora	0.8	0.2









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 341198.2163E 6612501.48N

Orientation: 90/180

Community: W-C

Landform Type: Low Rise/Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: SW

Soil Type: Sandy Loam

Soil Colour: Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid open heathland over low heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341198	6612492	SW Corner
Corner 2	341211	6612492	SE Corner
Corner 3	341210	6612502	NE Corner

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.25	0.1
Babingtonia urbana (P3)	1.1	4
Banksia attenuata	3	3
Banksia menziesii	3.2	6
Banksia telmatiaea	0.9	18
Calytrix flavescens	0.2	0.1
Cassytha flava		0.1
Cassytha racemosa		
Conospermum stoechadis subsp. stoechadis	0.6	0.1
Conostylis aculeata subsp. spinuligera	0.2	0.1
Conostylis ?juncea	0.25	0.1
Eremaea asterocarpa subsp. asterocarpa	0.6	4.5
Hakea obliqua subsp. parviflora		



Hibbertia hypericoides subsp. hypericoides	0.25	1
Hypocalymma quadrangulare (P3)	0.35	1
*Hypochaeris glabra	0.1	0.1
Jacksonia hakeoides	0.8	5
Leucopogon oldfieldii	0.5	2.5
Melaleuca seriata	0.45	2.5
Podotheca angustifolia	0.15	0.1
Regelia ciliata	1.2	6
Siloxerus humifusus		
Stirlingia latifolia	0.3	0.1
Stylidium purpureum		
Stylidium rigidulum		
Trachymene pilosa	0.07	0.1
Verticordia densiflora var. densiflora		
Verticordia lindleyi subsp. lindleyi (P4)	0.4	1









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 03/10/2022

GPS Location: GDA94 Zone 50 346209.12E 6608887.49N

Orientation: 90/180

Community: D-B

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Brown/Yellow

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low woodland, over mid open shrubland, over low sparse shrubland.

Comments: Existing quadrat NEW113

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	346218	6608891	NE Corner
Corner 2	346217	6608880	SE Corner
Corner 3	346209	6608880	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia prionotes

Mid Stratum 1: Hakea trifurcata

Mid Stratum 2: Hibbertia hypericoides subsp. hypericoides

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	1	0.2
Allocasuarina humilis	1.2	10
Anigozanthos humilis subsp. humilis	0.2	0.1
*Arctotheca calendula	0.1	0.1
Austrostipa macalpinei	0.2	0.1
Banksia prionotes	5	10
Brachyscome bellidioides	0.1	0.1



Burchardia congesta	0.3	0.1
	0.3	0.1
Cassytha flava Caustis dioica	0.2	0.1
	0.2	0.1
Conospermum stoechadis subsp. stoechadis	0.1	0.1
Conostylis teretifolia subsp. teretifolia	0.1	0.1
Dasypogon obliquifolius	0.1	0.1
Drosera erythrorhiza		0.1
Drosera thysanosepala		0.1
Eremaea pauciflora var. pauciflora	1.2	1
Hakea costata	0.4	0.1
Hakea trifurcata	1.8	10
Hibbertia hypericoides subsp. hypericoides	0.8	5
Hibbertia striata	0.2	0.1
Hypocalymma quadrangulare (P3)		
*Hypochaeris glabra	0.1	0.1
Isotropis cuneifolia subsp. cuneifolia	0.1	0.1
Jacksonia hakeoides	0.7	0.5
Laxmannia sessiliflora subsp. sessiliflora	0.1	0.1
Lepidobolus preissianus	0.4	0.5
Melaleuca clavifolia	0.3	0.1
Mesomelaena pseudostygia	0.5	0.1
Neurachne alopecuroidea	0.1	0.1
Opercularia vaginata	0.2	0.1
*Ornithopus compressus	0.1	0.1
*Ornithopus sativus	0.2	0.1
Patersonia occidentalis var. occidentalis	0.3	0.1
Petrophile macrostachya	0.1	0.1
Petrophile recurva	0.6	0.2
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.2	0.1
Pterochaeta paniculata	0.1	0.1
Schoenus clandestinus	0.1	0.1
Stirlingia latifolia	0.3	0.5
Stylidium purpureum	0.1	0.1
Stylidium repens	0.1	0.1
Thysanotus spiniger	0.3	0.1
Trachymene pilosa	0.1	0.1
Tricoryne elatior	0.3	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Wahlenbergia capensis	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.1
Xanthorrhoea preissii	1.2	1
xantnorrnoea preissii	1.2	1









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 345594.79E 6609540.89N

Orientation: 90/180

Community: W-E

Landform Type: Open Depression

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Clay Loam

Soil Colour: Brown
Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall shrubland over low sparse shrubland

Comments: Existing releve CW06

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345604	6609540	NE Corner
Corner 2	345605	6609531	SE Corner
Corner 3	345597	6609530	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Hakea trifurcata, Kunzea micrantha subsp. petiolata, Melaleuca incana subsp.

incana

Lower Stratum 1: Banksia telmatiaea

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.4	0.2
Acacia saligna subsp. Wheatbelt (B.R.	2	1
Maslin 8602)		
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Asteraceae sp.	0.1	0.1
Austrostipa macalpinei	0.2	0.1
Banksia telmatiaea	0.6	5



*Briza minor	0.1	0.1
Cassytha racemosa forma racemosa		0.1
Conostylis aculeata subsp. spinuligera	0.2	0.1
Drosera glanduligera	0.1	0.1
Exocarpos sparteus	1.6	0.1
Hakea trifurcata	2.2	10
Hakea varia	2	5
*Hypochaeris glabra	0.1	0.1
Kunzea micrantha subsp. petiolata	2	10
Melaleuca incana subsp. incana	2	20
Melaleuca rhaphiophylla	1	5
Melaleuca teretifolia	1	1
Melaleuca viminea subsp. viminea	1	2
Podotheca gnaphalioides	0.1	0.1
Siloxerus multiflorus	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.2	0.1
Viminaria juncea	3	1
?Viminaria juncea	0.1	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 345734.2525E 6609528.915N

Orientation: 90/180

Community: W-E

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Brown
Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid sparse shrubland over low sparse shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345739	6609531	NE Corner
Corner 2	345741	6609518	SE Corner
Corner 3	345732	6609518	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Eucalyptus rudis subsp. rudis, Exocarpos sparteus

Mid Stratum 1: Banksia telmatiaea, Kunzea micrantha subsp. petiolata

Mid Stratum 2: Melaleuca teretifolia

Taxon Name	Avg. Height	Cover Alive
Acacia saligna subsp. Wheatbelt (B.R.	0 0	
Maslin 8602)		
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
*Arctotheca calendula	0.1	0.1
Asteraceae sp.		
Austrostipa macalpinei	0.2	0.1
Banksia telmatiaea	1.2	2
*Briza maxima	0.2	0.1



		1
*Briza minor	0.1	0.1
Conostephium preissii	0.4	0.2
Drosera glanduligera	0.1	0.1
Eucalyptus rudis subsp. rudis	5	7
Exocarpos sparteus	5	2
*Hypochaeris glabra	0.2	0.1
Jacksonia sternbergiana	4	3
Kunzea micrantha subsp. petiolata	1.5	5
Lepidosperma cf. pubisquameum	0.5	0.1
*Lysimachia arvensis	0.1	0.1
Melaleuca teretifolia	0.8	8
Melaleuca viminea subsp. viminea		
Millotia myosotidifolia	0.1	0.1
*Parentucellia latifolia	0.1	0.1
Podotheca gnaphalioides	0.2	0.2
Siloxerus multiflorus	0.1	0.1
Thysanotus manglesianus		0.1
Trachymene pilosa	0.1	0.2
*Ursinia anthemoides subsp. anthemoides	0.2	0.1
Viminaria juncea	2	0.1
*Wahlenbergia capensis	0.1	0.1
•		





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 345628.8041E 6609716.093N

Orientation: 90/180

Community: D-B

Landform Type: Upper Slope

Slope Class: Gently Inclined (3 degrees)

Aspect: NW

Soil Type: Sandy Loam
Soil Colour: Brown/Yellow

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid sparse shrubland over low sparse shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345639	6609717	NE Corner
Corner 2	345639	6609707	SE Corner
Corner 3	345630	6609707	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata

Mid Stratum 1: Allocasuarina humilis, Conospermum stoechadis subsp. stoechadis, Eremaea

pauciflora var. pauciflora

Lower Stratum 1: Conostephium preissii, Hibbertia hypericoides subsp. hypericoides

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	1	0.1
Actinotus leucocephalus	0.1	0.1
Allocasuarina humilis	1.1	1
Anigozanthos humilis subsp. humilis	0.1	0.1
Apectospermum spinescens	0.8	0.1
Austrostipa macalpinei	0.2	0.1
Banksia attenuata	4	8



Banksia menziesii		
Bossiaea eriocarpa	0.3	0.1
Brachyscome bellidioides	0.1	0.1
Caladenia flava subsp. flava		
Centrolepis drummondiana		
Conospermum stoechadis subsp. stoechadis	1	5
Conostephium preissii	0.7	1
Conostylis aculeata subsp. spinuligera	0.2	0.1
Daviesia divaricata subsp. divaricata	1.1	0.5
Drosera erythrorhiza	0.1	0.1
Drosera humilis	0.1	0.1
Eremaea pauciflora var. pauciflora	1.1	5
Eucalyptus todtiana		
Hibbertia hypericoides subsp. hypericoides	0.8	1
Hibbertia striata	0.3	0.1
Lechenaultia linarioides	0.3	0.1
Lepidobolus preissianus	0.3	0.1
*Lysimachia arvensis	0.1	0.1
Macarthuria australis	0.2	0.1
Macrozamia fraseri		
Mesomelaena pseudostygia	0.2	0.1
Pigea calycina	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Rytidosperma setaceum	0.3	0.1
Sowerbaea laxiflora		
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 344258.27E 6610122.75N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Yellow

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid open shrubland over low open shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	344263	6610124	NE Corner
Corner 2	344266	6610113	SE Corner
Corner 3	344258	6610111	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Regelia ciliata

Lower Stratum 1: Calothamnus hirsutus

Taxon Name	Avg. Height	Cover Alive
	, wg. Height	COVET ATIVE
Acacia lasiocarpa var. lasiocarpa		
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Anigozanthos viridis subsp. Cataby (S.D.	0.2	0.1
Hopper 1786)		
Aphelia cyperoides	0.1	0.1
*Arctotheca calendula	0.1	0.1
Banksia nivea subsp. nivea	0.2	0.1
Banksia telmatiaea	1.1	2
Brachyscome bellidioides	0.1	0.1
Caladenia longicauda subsp. albella	0.2	0.1



Calothamnus hirsutus	0.6	10
Cassytha racemosa forma pilosa		0.1
Centrolepis aristata	0.1	0.1
Chaetanthus aristatus	0.1	0.1
Conostylis aculeata subsp. spinuligera	0.3	0.2
Daviesia decurrens subsp. decurrens	0.4	0.1
Daviesia incrassata subsp. teres	0.3	0.2
Drosera gigantea	0.2	0.1
Drosera glanduligera	0.1	0.1
Drosera menziesii	0.1	0.1
Elythranthera brunonis	0.1	0.1
Gnephosis drummondii	0.1	0.1
Goodenia trinervis		
Hakea varia	0.8	0.1
Hibbertia stellaris		
Hibbertia subvaginata	0.2	0.1
Isopogon panduratus subsp. palustris (P3)		
Melaleuca rhaphiophylla		
Melaleuca seriata		
Melaleuca viminea subsp. viminea		
Nuytsia floribunda		
Pericalymma ellipticum var. floridum		
Podotheca gnaphalioides	0.1	0.1
Pterochaeta paniculata	0.1	0.1
Pyrorchis nigricans		
Regelia ciliata	1	10
Schoenus subfascicularis	0.5	0.1
Siloxerus humifusus	0.1	0.1
Stylidium perpusillum	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.3	0.2
Verticordia lindleyi subsp. lindleyi (P4)		
*Vulpia myuros forma myuros	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 344604.2091E 6609821.094N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Loam

Soil Colour: Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid closed shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	344613	6609811	SE Corner
Corner 2	344613	6609821	NE Corner
Corner 3	344603	6609810	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Hakea obliqua subsp. parviflora, Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.6	0.1
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Austrostipa macalpinei	0.1	0.1
Banksia platycarpa	0.3	0.1
Banksia telmatiaea	1.3	20
Caladenia ?flava	0.1	0.1
Conostylis aculeata subsp. spinuligera	0.1	0.1
Drosera menziesii	0.1	0.1
Hakea obliqua subsp. parviflora	1.5	20
Hibbertia subvaginata	0.2	0.1
*Hypochaeris glabra	0.1	0.1
Isopogon panduratus subsp. palustris (P3)	1	0.2



Melaleuca seriata	1	1
Nuytsia floribunda		
Pericalymma ellipticum var. floridum	1	0.1
Petrophile seminuda	11	0.1
Podotheca gnaphalioides	0.1	0.1
Regelia ciliata	1.2	30
Schoenus subfascicularis	0.2	0.1
Siloxerus humifusus	0.6	0.1
Trachymene pilosa	0.1	0.1
Verticordia densiflora var. densiflora	0.5	0.2





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 345183.61E 6609202.17N

Orientation: 90/180

Community: D-A

Landform Type: Flat

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid sparse shrubland over low sparse shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345192	6609202	NE Corner
Corner 2	345193	6609194	SE Corner
Corner 3	345183	6609193	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata, Banksia menziesii

Mid Stratum 1: Eremaea pauciflora var. pauciflora

Lower Stratum 1: Bossiaea eriocarpa, Dasypogon obliquifolius, Patersonia occidentalis var.

occidentalis, Stirlingia latifolia

Taxon Name	Avg. Height	Cover Alive
Alexgeorgea nitens	0.2	0.1
Amphipogon turbinatus	0.2	0.1
Anigozanthos humilis subsp. humilis		
Austrostipa compressa	0.2	0.1
Austrostipa macalpinei	0.2	0.1
Banksia attenuata	4	8
Banksia menziesii	2	1
Banksia nivea subsp. nivea	0.1	0.2
Bossiaea eriocarpa	0.2	1



0.1.1.1.2.20.	0.4	0.4
Caladenia ?flava	0.1	0.1
Calandrinia corrigioloides	0.1	0.1
Conostephium preissii	0.1	0.1
Conostylis juncea	0.2	0.2
Dampiera linearis	0.2	0.1
Dasypogon obliquifolius	0.2	1
Daviesia divaricata subsp. divaricata	0.2	0.1
Drosera erythrorhiza	0.1	0.1
Drosera minutiflora	0.1	0.1
Eremaea pauciflora var. pauciflora	1	5
Hypocalymma quadrangulare (P3)	0.2	0.1
*Hypochaeris glabra	0.1	0.1
Isotropis cuneifolia subsp. cuneifolia	0.1	0.1
Lechenaultia stenosepala		
Lyginia barbata	0.1	0.1
Melaleuca clavifolia	0.5	0.1
Melaleuca seriata		
Patersonia occidentalis var. occidentalis	0.4	5
Petrophile linearis	0.1	0.1
Philotheca spicata	0.4	0.2
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Stirlingia latifolia	0.3	2
Stylidium bicolor	0.2	0.1
Stylidium rigidulum	0.1	0.1
Stylidium spiciforme	0.1	0.1
Synaphea spinulosa subsp. spinulosa	0.2	0.1
Trachymene pilosa	0.1	0.1
Xanthorrhoea preissii		
Xanthosia huegelii	0.1	0.1
		1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343625.1636E 6610478.319N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Yellow

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid sparse shrubland over low open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343634	6610481	NE Corner
Corner 2	343635	6610470	SE Corner
Corner 3	343625	6610470	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia menziesii, Banksia telmatiaea, Jacksonia hakeoides

Lower Stratum 1: Melaleuca seriata, Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.1	0.1
Banksia menziesii	1	1
Banksia telmatiaea	1	7
Beaufortia squarrosa	1.5	0.1
Centrolepis polygyna	0.1	0.1
Chordifex reseminans (P2)	0.2	0.3
Chordifex sinuosus	0.1	0.1
Conospermum scaposum (P3)	0.3	0.1
Conostylis aculeata subsp. spinuligera	0.2	0.1
Crassula exserta	0.1	0.1



Hibbertia subvaginata	0.1	0.1
Hypocalymma suave		
*Hypochaeris glabra	0.1	0.1
Hypolaena pubescens	0.1	0.1
Jacksonia hakeoides	1	1
Melaleuca seriata	0.4	2
Nuytsia floribunda		
Podotheca gnaphalioides	0.1	0.1
Regelia ciliata	0.8	2
Siloxerus humifusus	0.1	0.1
Stirlingia abrotanoides	0.3	0.1
Stirlingia latifolia	0.4	0.1
Stylidium spiciforme	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	1	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343812.985E 6610901.328N

Orientation: 90/180

Community: D-B

Landform Type: Upper Slope

Slope Class: Gently Inclined (3 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Yellow

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >5 Years

Habitat: Low open woodland over mid open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343822	6610902	NE Corner
Corner 2	343823	6610892	SE Corner
Corner 3	343813	6610892	SW Corner

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	1.1	1
Actinotus leucocephalus	0.1	0.1
Allocasuarina humilis		
Anigozanthos humilis subsp. humilis	0.1	0.1
Anigozanthos sp.	0.1	0.1
*Arctotheca calendula		
Asteraceae sp.	0.1	0.1
Austrostipa compressa	0.1	0.2
Banksia attenuata	4	5
Banksia menziesii	1.5	0.1
Banksia nivea subsp. nivea	0.1	0.1
Brachyscome bellidioides	0.1	0.1
Caladenia ?flava	0.1	0.1
Calandrinia corrigioloides	0.1	0.1



Centrolepis polygyna	0.1	0.1
Conospermum stoechadis subsp. stoechadis	1	4
Conostylis aculeata subsp. spinuligera	0.2	0.1
Conostylis teretifolia subsp. teretifolia	0.1	0.1
Corynotheca micrantha	0.1	0.1
Daviesia divaricata subsp. divaricata	1.2	0.5
Drosera humilis	0.1	0.1
Eremaea pauciflora var. pauciflora	0.6	0.5
Eucalyptus todtiana		
*Gladiolus caryophyllaceus	1	0.1
Hibbertia hypericoides subsp. hypericoides	0.6	5
Hibbertia striata	0.2	0.1
*Hypochaeris glabra	0.1	0.1
*Isolepis marginata	0.1	0.1
Lechenaultia linarioides	0.2	0.1
Lepidobolus preissianus	0.2	0.1
Leucopogon oldfieldii		
?Mesomelaena pseudostygia	0.2	0.1
Neurachne alopecuroidea	0.1	0.1
Petrophile linearis	0.3	0.1
Phyllangium divergens	0.1	0.1
Pigea calycina	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Rytidosperma setaceum	0.2	0.1
Schoenus clandestinus	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Wahlenbergia capensis	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343971.91E 6610652.3N

Orientation: 90/180

Community: D-B

Landform Type: Upper Slope

Slope Class: Gently Inclined (3 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Yellow

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343978	6610652	NE Corner
Corner 2	343982	6610645	SE Corner
Corner 3	343972	6610643	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata

Mid Stratum 1: Conospermum stoechadis subsp. stoechadis, Eremaea pauciflora var. pauciflora,

Hibbertia hypericoides subsp. hypericoides

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	1	0.1
Allocasuarina humilis		
Amphipogon turbinatus	0.2	0.1
Anigozanthos humilis subsp. humilis	0.1	0.1
Austrostipa compressa	0.1	0.2
Banksia attenuata	4	6
Banksia menziesii		
Burchardia congesta		
Calandrinia corrigioloides	0.1	0.1
Calandrinia granulifera	0.1	0.1



Conospermum stoechadis subsp. stoechadis	0.6	4
Conostylis aculeata subsp. spinuligera	0.2	0.1
Crassula exserta	0.1	0.1
Cryptandra pungens	0.8	0.1
Drosera ?drummondii		0.1
Drosera humilis	0.1	0.1
Drosera minutiflora	0.1	0.1
Eremaea pauciflora var. lonchophylla	0.2	0.1
Eremaea pauciflora var. pauciflora	0.8	10
Hibbertia hypericoides subsp. hypericoides	0.8	3
Hibbertia striata	0.2	0.2
*Isolepis marginata	0.1	0.1
Isotropis cuneifolia subsp. cuneifolia		
Jacksonia floribunda	0.4	0.1
Laxmannia sessiliflora subsp. sessiliflora	0.1	0.1
Lechenaultia linarioides	0.1	0.1
Lepidobolus preissianus	0.3	0.2
Leucopogon oldfieldii	0.3	0.1
Macrozamia fraseri		
Mesomelaena pseudostygia	0.3	0.1
Petrophile linearis	0.2	0.1
Podotheca chrysantha	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Poranthera asybosca (P1)	0.1	0.1
Pyrorchis nigricans		
Quoya verbascina	0.7	0.1
Rytidosperma setaceum	0.1	0.1
Schoenus clandestinus	0.1	0.1
Siloxerus humifusus	0.1	0.1
Stirlingia latifolia		
Stylidium rigidulum	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Wahlenbergia capensis	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 343368.08E 6611596.64N

Orientation: 90/180

Community: D-C

Landform Type: Crest

Slope Class: Moderately Inclined (10 degrees)

Soil Type: Clay Loam
Soil Colour: Red-Brown

Rock Outcrop: Ironstone, 20-50% bedrock exposed

CF Abundance: 20-50%

CF Sizes: 2-6mm, 6-20mm, 20-60mm

CF Types: Ironstone

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid shrubland over low open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343378	6611597	NE Corner
Corner 2	343378	6611589	SE Corner
Corner 3	343368	6611588	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia sessilis var. cygnorum, Hakea trifurcata, Xanthorrhoea preissii

Lower Stratum 1: Calothamnus quadrifidus subsp. angustifolius

Taxon Name	Avg. Height	Cover Alive
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Allocasuarina humilis	1.3	0.2
*Arctotheca calendula	0.4	0.1
*Avellinia festucoides	0.2	0.1
Banksia sessilis var. cygnorum	1.5	5
Bossiaea eriocarpa		
Burchardia congesta	0.2	0.1
Caladenia flava subsp. flava	0.1	0.1



Calandrinia corrigioloides	0.1	0.1
Calothamnus quadrifidus subsp.	0.5	2
angustifolius		
Crassula exserta	0.1	0.1
Daucus glochidiatus	0.2	0.1
Desmocladus asper	0.1	0.1
Euchiton sphaericus	0.1	0.1
*Galium murale	0.2	0.1
Goodenia coerulea	0.1	0.1
Hakea prostrata	0.4	0.1
Hakea trifurcata	1.3	15
*Heliophila pusilla	0.1	0.1
Hibbertia hypericoides subsp. hypericoides	0.4	0.2
Hibbertia striata	0.2	0.1
*Hypochaeris glabra	0.1	0.1
*Isolepis marginata	0.1	0.1
Kennedia prostrata	0.1	0.1
*Lysimachia arvensis	0.1	0.1
Millotia myosotidifolia	0.1	0.1
Opercularia vaginata	0.1	0.1
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
*Sonchus oleraceus	0.1	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Vulpia myuros forma myuros	0.1	0.1
*Wahlenbergia capensis	0.1	0.1
Xanthorrhoea preissii	1.4	3









Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 343568.8955E 6611514.745N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sand

Soil Colour: Grey/White

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid sparse shrubland over low open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343579	6611516	NE Corner
Corner 2	343577	6611505	SE Corner
Corner 3	343569	6611506	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Regelia ciliata

Lower Stratum 1: Acacia lasiocarpa var. lasiocarpa, Melaleuca seriata

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.8	1
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Austrostipa compressa	0.1	0.1
Banksia telmatiaea	1.1	5
Caladenia ?flava	0.1	0.1
Calandrinia granulifera	0.1	0.1
Cassytha flava		
Centrolepis drummondiana	0.1	0.1
Chordifex reseminans (P2)	0.2	0.1
Conospermum stoechadis subsp. stoechadis		



Conostylis aculeata subsp. spinuligera	0.2	0.1
Crassula exserta	0.1	0.1
*Gladiolus caryophyllaceus		
Hakea varia		
*Heliophila pusilla	0.1	0.1
Hibbertia subvaginata	0.2	0.1
*Hypochaeris glabra	0.1	0.1
*Isolepis marginata	0.1	0.1
Jacksonia hakeoides		
Levenhookia stipitata	0.1	0.1
Lyginia imberbis	0.1	0.1
Melaleuca rhaphiophylla		
Melaleuca seriata	0.6	1
Nuytsia floribunda	0.5	0.1
*Pentameris airoides subsp. airoides	0.1	0.1
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Pyrorchis nigricans	0.1	0.1
Regelia ciliata	0.9	5
Siloxerus humifusus	0.1	0.1
Stylidium dichotomum	0.1	0.1
Thysanotus manglesianus		0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.8	0.2
*Wahlenbergia capensis	0.1	0.1
Waitzia nitida		







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 341683.03E 6612979.78N

Orientation: 90/180

Community: D-A

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Clay

Soil Colour: Grey/Brown

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: None

Fire: >5 Years

Habitat: Low open woodland cover mid sparse shrubland over low sparse shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341688	6612980	NE Corner
Corner 2	341692	6612969	SE Corner
Corner 3	341681	6612970	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata, Banksia menziesii, Eucalyptus todtiana

Mid Stratum 1: Xanthorrhoea preissii

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	0.6	0.1
Actinotus leucocephalus	0.1	0.1
Adenanthos cygnorum subsp. cygnorum		
Alexgeorgea subterranea	0.1	0.1
Allocasuarina humilis		
Anigozanthos humilis subsp. humilis	0.1	0.1
Austrostipa compressa	0.2	0.1
Banksia attenuata	4	3



Banksia menziesii Bossiaea eriocarpa	5	4
Bossiaea eriocarpa	0 0	
	0.2	0.5
Chordifex sinuosus	0.1	0.2
Conostylis juncea	0.1	0.1
Cyanothamnus ramosus subsp. anethifolius	0.2	0.1
Dasypogon obliquifolius	0.1	0.1
Drosera drummondii	0.1	0.1
Drosera erythrorhiza	0.1	0.1
Eremaea asterocarpa subsp. asterocarpa	0.5	1
Eucalyptus todtiana	4	2
Gompholobium tomentosum	0.1	0.1
Hibbertia crassifolia	0.2	0.1
Hibbertia hypericoides subsp. hypericoides	0.3	0.2
Hibbertia pubens		
Hypocalymma quadrangulare (P3)	0.2	0.1
*Hypochaeris glabra		
Jacksonia hakeoides	1	1
Jacksonia nutans	1	1
Jacksonia sternbergiana		
Levenhookia stipitata	0.1	0.1
Melaleuca clavifolia	0.2	0.1
Melaleuca seriata	0.2	0.1
Nuytsia floribunda	0.2	0.1
Patersonia occidentalis var. occidentalis	0.3	0.1
Petrophile linearis	0.3	0.1
Phlebocarya filifolia	0.1	0.1
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Pterochaeta paniculata	0.1	0.1
Schoenus clandestinus	0.1	0.1
Siloxerus humifusus	0.1	0.1
Stirlingia latifolia		
Stylidium dichotomum	0.1	0.1
Stylidium diuroides subsp. diuroides	0.1	0.1
Stylidium rigidulum	0.1	0.1
Trachymene pilosa	0.1	0.1
Verticordia densiflora var. densiflora		
Wahlenbergia preissii	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.1
Xanthorrhoea preissii	1	4
Xanthosia huegelii	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339325.274E 6613560.112N

Orientation: 90/180

Community: W-D

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Clay Loam

Soil Colour: Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339333	6613561	NE Corner
Corner 2	339336	6613554	NE Corner
Corner 3	339326	6613551	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Melaleuca acutifolia, Melaleuca brevifolia, Melaleuca rhaphiophylla, Melaleuca

viminea subsp. viminea

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea	1	0.1
Carpobrotus sp.		
Cassytha aurea var. hirta		0.2
Centrolepis polygyna	0.1	0.1
Chaetanthus aristatus	0.2	0.1
Crassula exserta	0.1	0.1
Drosera ?drummondii		0.1
Euchiton sphaericus	0.1	0.1
Goodenia trinervis	0.3	0.1
Hakea varia	0.2	0.1



*Hypochaeris glabra	0.1	0.1
*Isolepis marginata	0.1	0.1
Melaleuca acutifolia	1.2	15
Melaleuca brevifolia	1.3	2
Melaleuca rhaphiophylla	1.2	5
Melaleuca viminea subsp. viminea	1.1	15
*Pentameris airoides subsp. airoides	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Samolus junceus	0.3	0.1
Thysanotus manglesianus		0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Vulpia myuros forma myuros	0.1	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339413.4042E 6613418.74N

Orientation: 90/180

Community: W-D

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Light Clay

Soil Colour: Red-Brown

Soil Condition: Dry

Rock Outcrop: Ironstone, <2% bedrock exposed

CF Abundance: <2%

CF Sizes: 2-6mm, 6-20mm, 20-60mm, 60-200mm

CF Types: Ironstone

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low isolated trees over mid shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339422	6613417	NE Corner
Corner 2	339422	6613409	SE Corner
Corner 3	339413	6613408	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Melaleuca rhaphiophylla

Mid Stratum 1: Melaleuca viminea subsp. viminea

Taxon Name	Avg. Height	Cover Alive
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Banksia nivea subsp. nivea		
Calandrinia granulifera	0.1	0.1
Cassytha aurea var. hirta		0.1
Cassytha racemosa forma racemosa		0.1
Centrolepis aristata	0.1	0.1
Centrolepis polygyna	0.1	0.1



*Cicendia filiformis	0.1	0.1
Crassula exserta	0.1	0.1
Euchiton sphaericus	0.1	0.1
Goodenia micrantha	0.1	0.1
Goodenia trinervis		
*Hypochaeris glabra	0.1	0.1
*Isolepis marginata	0.1	0.1
*Juncus capitatus	0.1	0.1
*Lysimachia arvensis	0.1	0.1
Melaleuca rhaphiophylla	2.1	1
Melaleuca viminea subsp. viminea	1.1	40
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Siloxerus multiflorus	0.1	0.1
Stylidium androsaceum	0.1	0.1
Thysanotus manglesianus		0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides		
?Viminaria juncea		
*Vulpia myuros forma myuros	0.1	0.1
	•	•





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339484.35E 6613800.73N

Orientation: 180/90

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Grey/Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid shrubland over low open shrubland

Comments: Ground very bare - no herbs.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	339493	6613801	NE Corner
Corner 2	339494	6613789	SE Corner
Corner 3	339483	6613788	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Hakea obliqua subsp. parviflora

Lower Stratum 1: Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.9	0.1
Banksia nivea subsp. nivea	0.2	0.5
Banksia telmatiaea	1	20
Beaufortia squarrosa	0.5	0.1
Hakea obliqua subsp. parviflora	1.1	2
Hakea varia	0.1	0.1
Hibbertia stellaris	0.1	0.1
Kunzea micrantha subsp. petiolata	1.2	0.1
Melaleuca brevifolia	1	1
Melaleuca seriata	0.3	0.1



Regelia ciliata	0.8	25	
Verticordia densiflora var. densiflora	1.2	0.1	





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 341488.4512E 6612836.46N

Orientation: 180/90

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Yellow/Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over low open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341497	6612836	NE Corner
Corner 2	341498	6612829	SE Corner
Corner 3	341489	6612829	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata, Banksia menziesii

Lower Stratum 1: Banksia telmatiaea, Melaleuca seriata

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.1	0.1
Austrostipa compressa	0.1	0.1
Banksia attenuata	3.5	3
Banksia menziesii	4	3
Banksia telmatiaea	0.6	4
Beaufortia squarrosa	2	0.2
Burchardia congesta	0.3	0.1
Calytrix aurea	1.6	0.1
Chordifex reseminans (P2)	0.1	0.1
Comesperma calymega	0.2	0.1
Conostylis aculeata subsp. spinuligera	0.7	0.1



Hakea obliqua subsp. parviflora	1.8	0.2
Hibbertia crassifolia	0.2	0.1
Hibbertia stellaris		
Hypocalymma balbakiae	0.3	0.2
Lyginia imberbis	0.2	0.1
Melaleuca seriata	0.5	2
Nuytsia floribunda		
Pericalymma ellipticum var. floridum		
Stirlingia latifolia		
Stylidium purpureum		
Stylidium repens	0.1	0.1
Tripterococcus brunonis		
Verticordia densiflora var. densiflora	0.8	0.1
Verticordia lindleyi subsp. lindleyi (P4)	1	0.1
Xanthorrhoea preissii	0.5	0.2





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340109.8721E 6612970.546N

Orientation: 180/90

Community: W-D

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340118	6612972	NE Corner
Corner 2	340119	6612959	SE Corner
Corner 3	340107	6612963	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

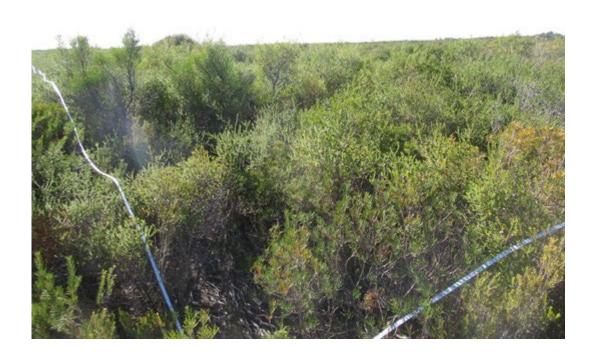
Mid Stratum 1: Banksia telmatiaea, Hakea obliqua subsp. parviflora, Melaleuca viminea subsp.

viminea, Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	1.2	0.2
Banksia telmatiaea	1	15
Cassytha glabella forma casuarinae		0.1
Chaetanthus aristatus	0.2	0.1
Conostylis aculeata subsp. spinuligera	0.1	0.1
Hakea obliqua subsp. parviflora	1.5	2
Hakea varia	0.3	0.1
*Hypochaeris glabra	0.1	0.1
Kunzea micrantha subsp. petiolata	1.1	0.5
Melaleuca viminea subsp. viminea	1.4	10



Regelia ciliata	1.2	30
Siloxerus humifusus	0.1	0.1
Trachymene pilosa	0.1	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340386.095E 6612786.61N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid sparse shrubland over low shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340395	6612786	
Corner 2	340397	6612777	
Corner 3	340385	6612777	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Hakea obliqua subsp. parviflora

Lower Stratum 1: Banksia telmatiaea, Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
Acacia dilatata	0.6	0.1
Banksia nivea subsp. nivea	0.2	0.1
Banksia telmatiaea	0.9	5
Beaufortia squarrosa		
Calytrix aurea		
Cassytha glabella forma casuarinae		0.1
Chaetanthus aristatus	0.3	0.1
Conostylis aculeata subsp. spinuligera	0.2	0.2
Daviesia incrassata subsp. teres	0.3	0.1
Desmocladus nodatus (P3)	0.1	0.1



Goodenia pulchella subsp. Coastal Plain A	0.1	0.1
(M. Hislop 634)		
Hakea obliqua subsp. parviflora	1.2	2
Hakea varia	0.3	0.1
Isopogon panduratus subsp. palustris (P3)	0.5	0.1
Melaleuca seriata	0.5	0.1
Regelia ciliata	0.8	35
Schoenus rigens	0.1	0.1
Stirlingia abrotanoides	0.1	0.1
Stylidium repens	0.1	0.1
Verticordia densiflora var. densiflora	0.2	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340809.5301E 6613400.187N

Orientation: 90/180

Community: W-E

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Clay Loam

Soil Colour: Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid open shrubland over low open shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340820	6613403	
Corner 2	340820	6613394	
Corner 3	340811	6613391	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Kunzea micrantha subsp. petiolata, Regelia ciliata

Lower Stratum 1: Hypocalymma balbakiae

Taxon Name	Avg. Height	Cover Alive
Acacia saligna subsp. Wheatbelt (B.R.		
Maslin 8602)		
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Banksia telmatiaea	1.3	5
Caladenia sp.	0.1	0.1
Cassytha glabella forma casuarinae		0.1
Centrolepis aristata	0.1	0.1
Centrolepis drummondiana	0.1	0.1
Centrolepis polygyna	0.1	0.1
Conostylis aculeata subsp. spinuligera		



0.1	0.1
0.1	0.1
0.1	0.1
0.6	10
0.1	0.1
1.6	1
0.2	0.1
0.1	0.1
0.1	0.1
0.1	0.1
1.5	0.1
0.1	0.1
0.1	0.1
1	3
0.4	0.1
0.1	0.1
0.1	0.1
0.2	0.1
0.1	0.1
0.1	0.1
0.1	0.1
0.2	0.1
	0.1 0.6 0.1 1.6 0.2 0.1 0.1 1.5 0.1 0.1 1.0.4 0.1 0.1 0.1 0.1 0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340949.6359E 6613459.127N

Orientation: 90/180

Community: W-E

Landform Type: Flat

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid open shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340960	6613461	NE Corner
Corner 2	340959	6613450	SE Corner
Corner 3	340949	6613448	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia littoralis, Melaleuca rhaphiophylla

Mid Stratum 1: Banksia telmatiaea, Xanthorrhoea preissii

Taxon Name	Avg. Height	Cover Alive
*Aira caryophyllea subsp. caryophyllea	0.1	0.1
Aphelia cyperoides	0.1	0.1
Austrostipa compressa	0.2	0.1
Banksia littoralis	5	4
Banksia menziesii		
Banksia telmatiaea	1.2	8
Burchardia congesta	0.1	0.1
Calothamnus quadrifidus subsp.		
angustifolius		
Centrolepis polygyna	0.1	0.1



Conostylis aculeata subsp. spinuligera	0.1	0.2
Hypocalymma balbakiae	0.2	0.1
*Hypochaeris glabra	0.1	0.1
Kennedia prostrata	0.1	0.1
Lepidosperma cf. pubisquameum	0.9	0.1
Levenhookia pusilla	0.1	0.1
Levenhookia stipitata	0.1	0.1
Lobelia rhytidosperma		
*Lysimachia arvensis	0.1	0.1
Melaleuca rhaphiophylla	4	4
Melaleuca seriata		
Olax scalariformis	0.2	0.1
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Siloxerus humifusus	0.1	0.1
Thysanotus manglesianus		
Trachymene pilosa	0.1	0.1
Tricoryne elatior	0.3	0.1
*Vulpia myuros forma myuros	0.1	0.1
Xanthorrhoea preissii	1	8





Site Name: OLF28

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 342697.208E 6611699.73N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall open shrubland over low open woodland over mid open shrubland over low

sparse shrubland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	342708	6611706	NE Corner
Corner 2	342709	6611695	SE Corner
Corner 3	342698	6611693	NW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia menziesii

Mid Stratum 1: Chamelaucium uncinatum

Mid Stratum 2: Xanthorrhoea preissii

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.1	0.1
Banksia attenuata	4	1
Banksia menziesii	4	2
Banksia nivea subsp. nivea		
Banksia telmatiaea	1	5
Caladenia sp.	0.1	0.1
Calothamnus quadrifidus subsp.		



angustifolius		
Calytrix aurea		
Cassytha glabella forma casuarinae		
Centrolepis drummondiana	0.1	0.1
Chamelaucium uncinatum	3	8
Conospermum stoechadis subsp. stoechadis		
Conostylis aculeata subsp. spinuligera	0.2	0.1
Crassula exserta	0.1	0.1
Eremaea asterocarpa subsp. asterocarpa		
Gonocarpus pithyoides	0.1	0.1
Hibbertia crassifolia	0.1	0.1
Hibbertia hypericoides subsp. hypericoides	0.3	0.2
Hibbertia subvaginata	0.2	0.2
Hovea pungens	0.2	0.1
Hypocalymma quadrangulare (P3)	0.2	0.1
*Hypochaeris glabra	0.1	0.1
Jacksonia nutans	1	0.2
Levenhookia stipitata	0.1	0.1
Melaleuca seriata	0.8	3
Nuytsia floribunda	0.3	0.1
Philotheca spicata	0.4	0.1
Podotheca gnaphalioides	0.1	0.1
Rytidosperma setaceum	0.2	0.1
Siloxerus humifusus	0.1	0.1
Stirlingia latifolia	0.2	0.1
Stylidium rigidulum	0.1	0.1
Trachymene pilosa	0.1	0.1
*Wahlenbergia capensis	0.2	0.1
Xanthorrhoea preissii	1	2







Site Name: OLF30

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 342322.2749E 6611491.482N

Orientation: 90/180

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low shrubland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	342328	6611493	NE Corner
Corner 2	342331	6611483	SE Corner
Corner 3	342322	6611482	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Lower Stratum 1: Banksia telmatiaea

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.1	0.1
Babingtonia urbana (P3)	0.8	0.2
Banksia menziesii	1	0.1
Banksia nivea subsp. nivea	0.1	0.1
Banksia telmatiaea	0.7	30
Beaufortia squarrosa	0.6	0.1
Burchardia congesta	0.2	0.1
Calytrix aurea	1	0.2
Cassytha glabella forma casuarinae		0.1
Chordifex reseminans (P2)	0.2	0.1
Conostylis aculeata subsp. spinuligera	0.1	0.1



Drosera erythrorhiza	0.1	0.1
Hakea obliqua subsp. parviflora		
Hibbertia subvaginata	0.1	0.1
*Hypochaeris glabra	0.1	0.1
Jacksonia hakeoides	0.2	0.1
Jacksonia nutans	1	0.1
Leucopogon oldfieldii	0.8	0.2
Lomandra suaveolens	0.2	0.1
Melaleuca seriata	0.8	0.2
Regelia ciliata	1	0.5
Stirlingia latifolia	0.3	0.2
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Wahlenbergia capensis	0.1	0.1





Site Name: OLF31

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341894.3E 6612639.2N

Orientation: 90/180

Community: D-A

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid sparse shrubland.

Comments: Existing quadrat NEW070

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341904	6612641	NE Corner
Corner 2	341905	6612632	SE Corner
Corner 3	341895	6612631	SW Corner

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: Banksia attenuata, Banksia menziesii

Mid Stratum 1: Eremaea asterocarpa subsp. asterocarpa, Jacksonia nutans, Melaleuca seriata

Taxon Name	Avg. Height	Cover Alive
Actinotus leucocephalus	0.1	0.1
Austrostipa compressa	0.2	0.1
Banksia attenuata	5	3
Banksia menziesii	4	1
Banksia prionotes		
Bossiaea eriocarpa	0.1	0.1
Cassytha glabella forma casuarinae		0.1
Conostylis juncea	0.2	0.1



Dasypogon obliquifolius	0.1	0.1
Drosera minutiflora	0.1	0.1
Eremaea asterocarpa subsp. asterocarpa	0.8	1
Eremaea beaufortioides var. beaufortioides	;	
Gompholobium tomentosum	0.1	0.1
Hibbertia crassifolia	0.2	0.1
Hibbertia hypericoides subsp. hypericoides		
Hibbertia subvaginata	0.1	0.1
Hypocalymma quadrangulare (P3)	0.2	0.1
Jacksonia hakeoides	1	0.2
Jacksonia nutans	1	2
Leucopogon oldfieldii	0.2	0.1
Levenhookia stipitata	0.1	0.1
Melaleuca clavifolia	0.5	0.5
Melaleuca seriata	1	2
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Poranthera asybosca (P1)	0.1	0.1
Pterochaeta paniculata	0.1	0.1
Siloxerus humifusus	0.1	0.1
Stirlingia latifolia		
Stylidium rigidulum	0.1	0.1
Thysanotus thyrsoideus	0.2	0.1
Trachymene pilosa	0.1	0.1
Verticordia densiflora var. densiflora		
*Wahlenbergia capensis	0.1	0.1
Waitzia suaveolens var. suaveolens	0.2	0.1
Xanthorrhoea preissii		
Xanthosia huegelii	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 03/10/2022

GPS Location: GDA94 Zone 50 345572.54E 6608766.3N

Orientation: 90/180

Community: W-A

Landform Type: Lower Slope

Slope Class: Very Gently Inclined (1 degree)

Aspect: W

Soil Type: Sandy Clay Loam

Soil Colour: Grey/Yellow/Orange

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 3 - Very Good

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

Habitat: Mid shrubland of *Melaleuca* spp. over isolated clumps of *Calothamnus* spp.

over herbs

Comments: Existing releve CW12

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345565	6608763	
Corner 2	345558	6608777	
Corner 3	345572	6608777	

Taxon Name	Avg. Height	Cover Alive
Acacia saligna subsp. Wheatbelt (B.R.	0.1	0.1
Maslin 8602)		
Austrostipa compressa	0.1	0.2
Banksia telmatiaea	0.2	0.3
Blennospora drummondii	0.1	0.1
Borya sphaerocephala	0.1	0.1
Brachyscome pusilla	0.1	0.1
*Briza maxima	0.1	0.1
Caladenia ?flava	0.1	0.1
Caladenia longicauda subsp. albella	0.2	0.1
Cassytha flava		0.1



Cassytha racemosa forma pilosa		0.1
Centrolepis aristata	0.1	0.1
Chamaescilla versicolor	0.2	0.1
Conostylis aculeata subsp. breviflora	0.3	0.2
Crassula closiana	0.1	0.1
Crassula exserta	0.1	0.1
Cyathochaeta avenacea	1	1
Darwinia pinifolia	0.1	0.1
Drosera glanduligera	0.1	0.1
Drosera menziesii	0.1	0.2
*Ehrharta calycina	0.6	0.5
Gnephosis drummondii	0.1	0.1
Gonocarpus nodulosus	0.1	0.1
Goodenia micrantha	0.1	0.1
Haemodorum simplex	0.3	0.2
Hakea lissocarpha	0.6	0.5
Hakea varia	1.5	2.5
Hyalosperma cotula	0.1	0.2
Hypocalymma balbakiae	0.4	0.6
*Hypochaeris glabra	0.1	0.2
*Juncus capitatus	0.1	0.1
Leptocarpus canus	0.2	0.3
Lomandra suaveolens	0.1	0.2
Melaleuca seriata	0.5	1
Melaleuca viminea subsp. viminea	1	8
Neurachne alopecuroidea	0.2	2
Opercularia vaginata	0.1	0.2
*Ornithopus compressus	0.1	0.1
Panaetia lessonii	0.1	0.6
*Parentucellia latifolia	0.1	0.1
Patersonia occidentalis var. occidentalis	0.4	0.3
*Pentameris airoides subsp. airoides	0.1	0.1
Petrophile seminuda	0.4	0.5
Podotheca gnaphalioides	0.1	0.1
Ptilotus manglesii	0.1	0.1
Quinetia urvillei	0.1	0.1
Schoenus subfascicularis	0.4	0.3
Schoenus subflavus	0.1	0.1
Siloxerus multiflorus	0.1	0.1
Sowerbaea laxiflora	0.5	0.3
Stylidium calcaratum	0.1	0.1
Thryptomene hyporhytis	0.3	0.3
Tribonanthes australis		
Tribonanthes variabilis	0.2	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Utricularia multifida	0.1	0.1
· · · · · · · · · · · · · · · · · · ·	_1	1



Verticordia densiflora var. densiflora	0.5	1
*Vulpia myuros forma myuros	0.2	0.1
Waitzia acuminata var. albicans	0.1	0.1
Xanthorrhoea preissii		
Xanthosia huegelii	0.1	0.3





Site Type: QUADRAT

Dimensions: 10m x 10m

04/10/2022 Survey Date:

GPS Location: GDA94 Zone 50 347611.97E 6606580.22N

Orientation: 90/180

W-C Community:

Landform Type: **Open Depression**

Slope Class: Very Gently Inclined (1 degree)

Aspect: NE

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

>10 Years Fire:

SITE POINTS

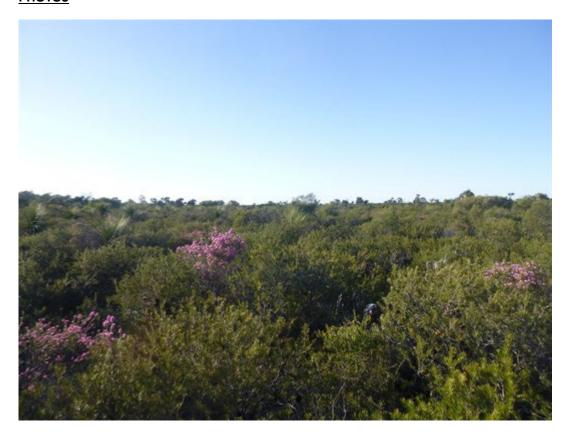
Label	Easting	Northing	Comments
Corner 1	347621	6606570	
Corner 2	347609	6606569	
Corner 3	347618	6606581	

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	1	0.8
Amphipogon caricinus var. caricinus	0.1	0.1
Anarthria grandiflora	0.3	0.2
Austrostipa compressa	0.2	0.1
Banksia nivea subsp. nivea	0.2	0.1
Banksia telmatiaea	1.4	40
Blennospora drummondii	0.1	0.1
Borya sphaerocephala	0.1	0.1
Burchardia congesta	0.2	0.2
Caladenia ?flava	0.1	0.1
Calytrix aurea	0.3	0.2
Cassytha flava	0.1	0.1
Cassytha racemosa forma pilosa		0.1
Caustis dioica	0.4	0.2
Centrolepis aristata	0.1	0.1
Chordifex reseminans (P2)	0.3	0.3



Chordifex sinuosus	0.2	0.2
Conospermum stoechadis subsp. stoechadis	0.9	0.4
Conostylis aculeata subsp. breviflora	0.2	0.1
Conostylis aculeata subsp. spinuligera	0.2	0.1
Conostylis crassinerva subsp. absens	0.1	0.2
Drosera menziesii	0.1	0.1
Drosera sp.	0.1	0.1
Elythranthera brunonis	0.1	0.1
*Gladiolus caryophyllaceus	0.2	0.1
Hakea obliqua subsp. parviflora	1.5	1
Hydrocotyle callicarpa	0.1	0.1
*Hypochaeris glabra	0.1	0.1
Isotropis cuneifolia subsp. cuneifolia	0.1	0.1
Jacksonia nutans	0.1	0.1
	0.3	0.2
Leptocarpus canus	0.3	
Lepyrodia curvescens (P2)		0.1
Leucopogon oliganthus	0.2	0.1
Lomandra suaveolens	0.1	0.1
Melaleuca seriata	1.5	6
Opercularia vaginata	0.2	0.2
Persoonia rudis (P3)	0.4	0.4
Petrophile brevifolia sens. lat.	0.5	0.4
Petrophile seminuda	0.4	0.6
Pimelea imbricata var. piligera	0.4	0.2
Podotheca angustifolia	0.1	0.1
Ptilotus manglesii	0.1	0.2
Scaevola repens var. repens	0.1	0.1
Schoenus griffinianus (P4)	0.1	0.3
Schoenus rigens	0.3	0.2
Siloxerus humifusus	0.1	0.1
Stylidium dichotomum	0.1	0.2
Stylidium petiolare	0.1	0.1
Stylidium repens	0.1	0.1
Stylidium rigidulum	0.1	0.1
Styphelia tortifolia	0.2	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia lindleyi subsp. lindleyi (P4)	0.4	0.2
Xanthorrhoea preissii	1.5	1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 347419.04E 6606898.32N

Orientation: 90/180

Community: W-A

Landform Type: Open Depression

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Brown/Black

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Habitat: Melaleuca rhaphiophylla and Melaleuca teretifolia, over Verticordia densiflora

var. densiflora and Petrophile seminuda, over Conostylis aculeata subsp.

breviflora, over sparse sedges over annual herbland.

SITE POINTS

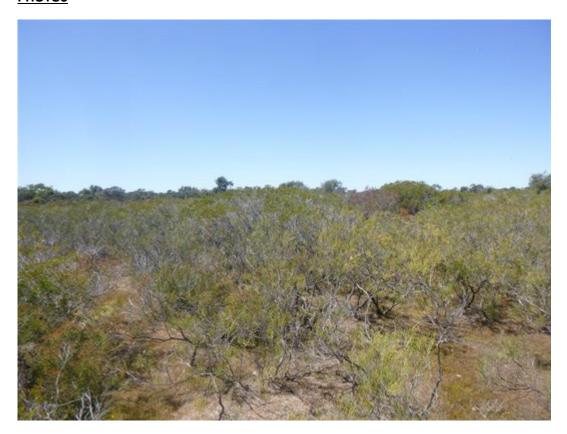
Label	Easting	Northing	Comments
Corner 1	347428	6606883	
Corner 2	347418	6606884	
Corner 3	347428	6606895	

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.1	0.1
Blennospora drummondii	0.1	0.1
*Briza maxima	0.1	0.1
*Briza minor	0.1	0.1
Cassytha racemosa forma pilosa		0.1
Centrolepis aristata	0.1	0.1
*Cicendia filiformis	0.1	0.1
Conostylis aculeata subsp. breviflora	0.3	0.3
Drosera gigantea	0.5	0.3
Drosera glanduligera	0.1	0.1
Drosera menziesii	0.1	0.1
<i>Drosera</i> sp.	0.1	0.1
Exocarpos sparteus		
Gnephosis drummondii	0.1	0.1



Gonocarpus nodulosus	0.1	0.1
Goodenia micrantha	0.1	0.1
Goodenia trinervis	0.1	0.1
Hydrocotyle alata	0.1	0.1
*Hypochaeris glabra	0.1	0.1
Leptocarpus canus	0.5	0.2
*Lysimachia arvensis	0.1	0.1
Melaleuca rhaphiophylla	1.8	8
Melaleuca seriata		
Melaleuca teretifolia	1.6	30
Opercularia vaginata	0.1	0.2
*Parentucellia latifolia	0.1	0.1
Patersonia occidentalis var. occidentalis	0.5	0.4
*Pentameris airoides subsp. airoides	0.1	0.1
Petrophile seminuda	0.5	1
Philydrella pygmaea subsp. pygmaea	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Schoenus odontocarpus	0.1	0.1
Schoenus subfascicularis	0.3	0.2
Siloxerus humifusus	0.1	0.1
Siloxerus multiflorus	0.1	0.2
Stylidium calcaratum	0.1	0.1
Stylidium divaricatum	0.1	0.2
Stylidium obtusatum	0.1	0.1
Thelymitra vulgaris	0.2	0.1
Tribonanthes variabilis	0.1	0.2
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.4	1
Wurmbea dioica subsp. alba	0.1	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 347062.67E 6606820.54N

Orientation: 180/270

Community: D-A

Landform Type: Mid Slope

Slope Class: Gently Inclined (3 degrees)

Aspect: N

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	347065	6606811	
Corner 2	347055	6606811	
Corner 3	347055	6606818	

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	0.1	0.1
Alexgeorgea nitens	0.1	0.1
Amphipogon turbinatus	0.3	0.2
Anigozanthos humilis subsp. humilis	0.2	0.1
Banksia attenuata	2.5	10
Banksia menziesii	2.5	2
Blancoa canescens	0.2	0.3
Bossiaea eriocarpa	0.3	0.5
Burchardia congesta	0.5	0.1
Calytrix flavescens	0.2	0.2
Cassytha flava		0.3
Cassytha racemosa forma pilosa		0.2
Conospermum stoechadis subsp. stoechadis		
Conostylis crassinerva subsp. absens	0.2	0.1
Conostylis juncea	0.2	0.1
Conostylis teretifolia subsp. teretifolia	0.2	0.2



0.6 0.1 0.1 0.1 0.6 10 0.1 0.1 0.2
0.1 0.1 0.6 10 0.1 0.1
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0.5
0.1
0.5
0.1
3
1
1
0.2
0.2
0.3
0.1
1.8
0.1
0.4
0.2
0.2
0.1
0.1
0.1
0.2
0.1
0.1
0.2
0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 347451.13E 6607183.8N

Orientation: 90/180

Community: D-A

Landform Type: Mid Slope

Slope Class: Gently Inclined (3 degrees)

Aspect: SW

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Comments: Existing quadrat NEW121

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	347460	6607188	
Corner 2	347460	6607176	
Corner 3	347450	6607175	

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	0.3	0.3
Alexgeorgea nitens	0.2	0.1
Allocasuarina humilis		
Amphipogon caricinus var. caricinus	0.1	0.1
Amphipogon turbinatus	0.3	0.4
Anigozanthos humilis subsp. humilis	0.2	0.1
Austrostipa compressa	0.1	0.1
Austrostipa macalpinei	0.3	0.1
Banksia attenuata	2.5	18
Banksia menziesii	2	1
Beaufortia elegans	0.2	0.1
Bossiaea eriocarpa	0.84	1.5
Burchardia congesta	0.5	0.1
Caladenia flava subsp. flava	0.1	0.1



Calytrix flavescens	0.4	2
	0.4	0.2
Calytrix fraseri Cassytha racemosa forma pilosa	0.4	0.2
	0.4	0.2
Chaetospora curvifolia	0.4	0.2
Conospermum stoechadis subsp. stoechadis	0.4	0.2
Conospermum teretifolium	0.1	0.2
Conostephium pendulum	0.3	0.2
Conostylis angustifolia	0.3	0.4
Conostylis juncea	0.3	0.3
Dasypogon obliquifolius	0.4	3
Drosera ?drummondii		0.1
Drosera ?eneabba	0.1	0.1
Drosera erythrorhiza		0.2
Eremaea pauciflora var. pauciflora	1.7	7
Hemiphora bartlingii	0.3	0.2
Hibbertia crassifolia	0.4	0.7
Hibbertia hypericoides subsp. hypericoides	0.4	5
Hibbertia striata	0.2	0.3
Hypocalymma xanthopetalum	0.3	0.6
*Hypochaeris glabra	0.1	0.1
lsotropis cuneifolia subsp. cuneifolia	0.1	0.1
Johnsonia pubescens subsp. pubescens	0.1	0.1
Lepidosperma cf. pubisquameum	0.3	0.1
Lomandra suaveolens	0.1	0.1
Lyginia barbata	0.4	0.1
Melaleuca clavifolia	0.6	3
Mesomelaena pseudostygia	0.4	2.7
?Paracaleana sp.	0.1	0.1
Patersonia occidentalis var. occidentalis	0.4	1
Persoonia comata		
Petrophile linearis	0.3	0.4
Petrophile macrostachya	0.3	0.1
Philotheca spicata	0.5	0.2
Phyllangium divergens	0.1	0.1
Pimelea sulphurea	0.5	0.1
Podotheca gnaphalioides	0.1	0.1
Poranthera asybosca (P1)	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Schoenus clandestinus	0.1	0.3
Scholtzia involucrata	0.6	0.5
Stirlingia latifolia	0.4	0.4
Stylidium araeophyllum	0.3	0.1
Stylidium bicolor	0.3	0.1
Stylidium crossocephalum	0.2	0.1
Stylidium diuroides subsp. diuroides	0.2	0.1
Stylidium repens	0.1	0.1
Stylidium repens	0.1	0.1



Styphelia conostephioides	0.2	0.2
Styphelia xerophylla	0.2	0.2
Synaphea spinulosa subsp. spinulosa	0.3	0.5
Thysanotus thyrsoideus	0.4	0.1
Xanthorrhoea preissii		
Xanthosia huegelii	0.1	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 345911.71E 6607123.18N

Orientation: 270/0

Community: W-D

Landform Type: Open Depression

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Black

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345901	6607121	
Corner 2	345898	6607132	
Corner 3	345911	6607132	

Taxon Name	Avg. Height	Cover Alive
Acacia applanata	0.5	1
Acacia saligna subsp. Wheatbelt (B.R.	0.5	0.1
Maslin 8602)		
Anarthria laevis	0.6	1
*Avellinia festucoides	0.1	0.2
Banksia nivea subsp. nivea	0.3	0.5
Banksia telmatiaea	1.5	5
Burchardia congesta	0.4	0.1
Caladenia flava subsp. flava	0.1	0.1
Cassytha racemosa forma pilosa		0.1
Crassula closiana	0.1	0.2
Drosera glanduligera	0.1	0.1
Euchiton sphaericus	0.1	0.1
Gahnia trifida	1.1	5
Goodenia pulchella subsp. Coastal Plain A	0.3	0.2
(M. Hislop 634)		



Halan a consis	1.2	0.5
Hakea varia	1.2	0.5
Hydrocotyle callicarpa	0.1	0.1
*Hypochaeris glabra	0.2	0.1
Kunzea micrantha subsp. petiolata	1.3	7
Levenhookia stipitata	0.1	0.1
Melaleuca brevifolia	0.6	1
Melaleuca incana subsp. incana	1.6	1.5
Melaleuca viminea subsp. viminea	1	2.5
Nuytsia floribunda		
Panaetia lessonii	0.1	0.1
Patersonia occidentalis var. occidentalis	0.3	0.1
*Pentameris airoides subsp. airoides	0.1	0.1
Phyllangium divergens	0.1	0.1
?Podolepis sp.	0.2	0.1
Podotheca gnaphalioides	0.2	0.1
Poranthera microphylla	0.1	0.3
Scaevola repens var. repens	0.2	0.2
Schoenus subfascicularis	0.4	0.2
Siloxerus humifusus	0.1	0.1
Siloxerus multiflorus	0.7	0.1
Thysanotus manglesianus		0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Wahlenbergia capensis	0.2	0.1
Wahlenbergia preissii	0.1	0.1
Wurmbea dioica subsp. alba	0.1	0.1
Xanthorrhoea preissii	1.2	1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 345497.6E 6607068.02N

Orientation: 180/270

Community: D-A

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: NW

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	345498	6607057	
Corner 2	345489	6607054	
Corner 3	345488	6607067	

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.6	1
Acacia pulchella var. glaberrima	0.9	0.3
Alexgeorgea nitens	0.1	0.3
Amphipogon turbinatus	0.2	0.2
Anigozanthos humilis subsp. humilis	0.2	0.2
Anigozanthos pulcherrimus	0.3	0.1
Aphelia cyperoides	0.1	0.1
*Arctotheca calendula	0.1	0.1
Austrostipa macalpinei	0.1	0.1
Banksia attenuata	3	4
Banksia menziesii	2	1
Banksia nivea subsp. nivea	0.2	0.5
Blancoa canescens	0.3	0.4
Blennospora drummondii	0.1	0.1



Bossiaea eriocarpa	0.3	0.9
Burchardia congesta	0.5	0.1
Caladenia flava subsp. flava	0.1	0.1
Calytrix flavescens	0.3	0.2
Cassytha flava		0.1
Caustis dioica	0.3	0.3
Centrolepis drummondiana		
Centrolepis mutica	0.1	0.1
Centrolepis pilosa		
Conospermum stoechadis subsp. stoechadis	0.9	2
Conostylis juncea	0.3	0.3
Dasypogon obliquifolius	0.4	5
Drosera erythrorhiza	0.1	0.1
Drosera menziesii	0.1	0.1
Eremaea pauciflora var. pauciflora	0.6	2.5
Eucalyptus todtiana		
*Gladiolus caryophyllaceus	0.3	0.1
Haemodorum spicatum		
Hibbertia hypericoides subsp. hypericoides	0.4	2
Hibbertia racemosa	0.3	0.1
Hypocalymma xanthopetalum	0.3	0.5
*Hypochaeris glabra	0.1	0.1
Isotropis cuneifolia subsp. cuneifolia	0.1	0.1
Jacksonia nutans	0.6	0.8
Lepidosperma cf. pubisquameum	0.4	0.3
Levenhookia stipitata	0.1	0.1
Melaleuca clavifolia	0.3	0.2
Melaleuca seriata	0.4	0.3
Mesomelaena pseudostygia	0.4	0.8
Neurachne alopecuroidea	0.1	0.3
Nuytsia floribunda		
Opercularia vaginata	0.2	0.2
Patersonia occidentalis var. occidentalis	0.5	0.4
*Pentameris airoides subsp. airoides	0.1	0.1
Petrophile linearis	0.3	0.3
Petrophile macrostachya		
Phlebocarya ciliata	0.3	0.2
Phyllangium divergens	0.1	0.1
Podotheca angustifolia	0.1	0.1
Podotheca gnaphalioides	0.1	1
Ptilotus polystachyus	0.3	0.1
Quinetia urvillei	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Schoenus clandestinus	0.1	0.2
Scholtzia involucrata	0.5	0.6
Siloxerus humifusus	0.1	0.1
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Stirlingia latifolia	0.3	0.6
Stylidium divaricatum	0.2	0.2
Stylidium repens	0.1	0.1
Synaphea spinulosa subsp. spinulosa	0.4	0.8
Thysanotus spiniger	0.3	0.3
Thysanotus thyrsoideus	0.5	0.1
Triglochin nana	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Vulpia myuros forma myuros	0.1	0.1
*Wahlenbergia capensis	0.2	0.1
Waitzia suaveolens var. suaveolens	0.2	0.1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343504.66E 6610583.33N

Orientation: 90/180

Community: W-C

Landform Type: Lower Slope

Slope Class: Very Gently Inclined (1 degree)

Aspect: NE

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343515	6610587	
Corner 2	343515	6610576	
Corner 3	343507	6610575	

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	2	1.4
Austrostipa compressa	0.2	0.1
Banksia attenuata	1.6	0.9
Banksia platycarpa	0.5	0.2
Banksia prionotes	3.4	12
Banksia telmatiaea	1	7
Beaufortia elegans	1.2	0.8
Beaufortia squarrosa	1.6	2
Caladenia flava subsp. flava	0.1	0.1
Cassytha flava		0.2
Chordifex reseminans (P2)	0.2	0.2
Conostylis aculeata subsp. breviflora	0.3	0.2
Hakea obliqua subsp. parviflora	1.7	0.5
Hibbertia stellaris	0.3	0.4
Hibbertia subvaginata	0.3	0.5
Isopogon panduratus subsp. palustris (P3)	1	2



Jacksonia nutans	1.6	0.8
Lepidobolus preissianus	0.4	0.2
Podotheca angustifolia	0.1	0.1
Regelia ciliata	1.5	3
Scaevola repens var. repens	0.1	0.1
Siloxerus humifusus	0.1	0.1
Stylidium dichotomum	0.1	0.1
Stylidium purpureum	0.3	0.1
Stylidium repens	0.1	0.1
Styphelia conostephioides	0.2	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.8	2.5
Verticordia lindleyi subsp. lindleyi (P4)	0.4	0.3
Xanthorrhoea preissii	0.3	0.5
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Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343071.05E 6610627.47N

Orientation: 90/180

Community: D-B

Landform Type: Upper Slope

Slope Class: Very Gently Inclined (1 degree)

Aspect: NE

Soil Type: Sand

Soil Colour: Grey/White

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343080	6610626	
Corner 2	343081	6610617	
Corner 3	343073	6610618	

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	0.9	0.5
Actinotus leucocephalus	0.1	0.1
Adenanthos cygnorum subsp. cygnorum	2.5	3
Allocasuarina humilis		
Amphipogon turbinatus	0.3	0.1
Anigozanthos humilis subsp. humilis	0.2	0.2
Anigozanthos pulcherrimus	0.5	0.2
Austrostipa compressa	0.2	0.2
Banksia attenuata	3.3	4
Banksia menziesii	2.5	1.5
Burchardia congesta	0.4	0.1
Cassytha racemosa forma pilosa		0.2
Conospermum stoechadis subsp. stoechadis	0.8	0.9
Dasypogon obliquifolius		
Drosera ?drummondii		0.1
Drosera ?eneabba	0.1	0.1



Drosera erythrorhiza	0.1	0.1
Drosera humilis	0.1	0.1
Drosera menziesii		0.1
Eremaea pauciflora var. pauciflora	1.6	9
Eucalyptus todtiana	1.9	1
Gyrostemon subnudus		
Hibbertia hypericoides subsp. hypericoides	1	5
Hibbertia striata	0.4	0.8
Hypocalymma xanthopetalum	0.3	0.2
Jacksonia floribunda	0.6	0.3
Jacksonia nutans	0.7	0.8
Lepidobolus preissianus	0.4	0.2
Melaleuca clavifolia		
Mesomelaena pseudostygia	0.4	0.4
Petrophile linearis	0.3	0.1
Petrophile macrostachya	0.5	0.8
Podotheca angustifolia		
Poranthera asybosca (P1)	0.1	0.1
Pterostylis vittata		
Scaevola repens var. repens	0.1	0.1
Scaevola repens var. repens	0.1	0.6
Schoenus clandestinus	0.1	0.3
Schoenus pleiostemoneus	0.2	0.2
Stirlingia latifolia		
Stylidium crossocephalum		
Stylidium rigidulum	0.1	0.1
Thysanotus spiniger	0.3	0.2
Thysanotus thyrsoideus	0.2	0.1
Tricoryne elatior	0.2	0.1
*Wahlenbergia capensis		
Waitzia suaveolens var. suaveolens		







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343216.06E 6611322.81N

Orientation: 90/180

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	343224	6611325	
Corner 2	343225	6611315	
Corner 3	343218	6611313	

Taxon Name	Avg. Height	Cover Alive
Austrostipa compressa	0.1	0.1
Banksia nivea subsp. nivea	0.3	0.3
Banksia platycarpa	1	0.9
Banksia telmatiaea	1.1	60
Beaufortia squarrosa		
Calytrix aurea		
Chordifex reseminans (P2)	0.2	0.1
Conostylis aculeata subsp. breviflora	0.2	0.2
Conostylis aculeata subsp. spinuligera	0.2	0.3
Daviesia incrassata		
Desmocladus nodatus (P3)	0.2	0.1
Hakea costata	0.9	0.5
Hakea obliqua subsp. parviflora	1.6	4
Hibbertia subvaginata	0.3	0.3
*Hypochaeris glabra	0.1	0.1
Isopogon panduratus subsp. palustris (P3)	0.9	0.4
Jacksonia hakeoides	0.4	0.5



Laxmannia ramosa subsp. ramosa	0.1	0.1
Lomandra suaveolens	0.3	0.1
Melaleuca rhaphiophylla		
Melaleuca seriata	1	1
Nuytsia floribunda		
Petrophile seminuda	0.4	0.3
Podotheca angustifolia	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Pyrorchis nigricans	0.1	0.1
Regelia ciliata	1.5	8
Scaevola repens var. repens	0.1	0.1
Siloxerus humifusus		
Stirlingia latifolia	0.3	0.2
Stylidium repens	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.4	0.2





Site Name: OMP11

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 342938.8E 6611221.99N

Orientation: 180/270

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	342942	6611212	
Corner 2	342932	6611207	
Corner 3	342929	6611220	

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.1	0.1
Austrostipa compressa	0.1	0.1
Banksia attenuata	1.6	1
Banksia nivea subsp. nivea	0.2	0.2
Banksia platycarpa	0.6	0.3
Banksia telmatiaea	0.9	25
Calytrix aurea	1.8	0.8
Cassytha racemosa forma pilosa		0.2
Chordifex reseminans (P2)	0.3	0.1
Conospermum stoechadis subsp. stoechadis	1	1
Conostylis juncea	0.3	0.1
Daviesia incrassata	0.4	0.4
Desmocladus nodatus (P3)	0.2	0.1
Hakea costata	1	0.3
Hakea obliqua subsp. parviflora		
Hibbertia subvaginata	0.3	0.1
Hypocalymma xanthopetalum	0.3	0.2



*Hypochaeris glabra	0.1	0.1
Jacksonia hakeoides	0.6	0.7
Laxmannia ramosa subsp. ramosa	0.1	0.1
Leucopogon oldfieldii	0.5	0.3
Lyginia imberbis	0.3	0.1
Melaleuca preissiana		
Melaleuca seriata	1	10
Nuytsia floribunda		
Petrophile brevifolia sens. lat.	2.3	0.3
Podotheca gnaphalioides	0.1	0.1
Regelia ciliata	1.2	6
Scaevola repens var. repens	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
Verticordia densiflora var. densiflora	0.4	0.2





Site Name: OMP12

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 342454.78E 6611236.33N

Orientation: 90/180

Community: W-D

Landform Type: Flat/Open Depression

Slope Class: Level (0 degrees)

Soil Type: Sandy Clay Loam

Soil Colour: Brown/Black

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 3 - Very Good

Disturbance: Exotic Weeds, Track nearby

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	342445	6611237	
Corner 2	342442	6611246	
Corner 3	342454	6611245	

Taxon Name	Avg. Height	Cover Alive
Acacia cyclops	1.8	1
*Aira cupaniana	0.1	0.1
*Avellinia festucoides	0.1	0.1
Banksia telmatiaea	0.9	0.2
Brachyscome pusilla	0.1	0.2
Carpobrotus virescens	0.2	0.1
Cassytha aurea var. hirta		0.2
Chaetanthus aristatus	0.5	0.3
Crassula exserta	0.1	0.2
?Exocarpos sp.	0.2	0.1
Exocarpos sparteus	1.3	0.2
Gahnia trifida	0.3	0.3
Grevillea cooljarloo (P1)		
*Heliophila pusilla	0.1	0.1
*Hypochaeris glabra	0.1	0.3
Melaleuca acutifolia	2.1	2.3



Melaleuca brevifolia	0.1	0.2
Melaleuca viminea subsp. viminea	1.5	1.5
Olearia axillaris	0.2	3
Podotheca angustifolia	0.1	0.1
Regelia ciliata	1	1
Rhagodia baccata subsp. baccata	0.8	0.5
Samolus junceus	0.5	0.3
Scaevola repens var. repens	0.1	0.1
Senecio pinnatifolius var. latilobus	0.1	0.1
*Trifolium arvense var. arvense	0.1	0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.3
Verticordia densiflora var. densiflora	0.5	0.3
*Vulpia myuros forma myuros	0.1	0.1
Wahlenbergia preissii	0.1	0.1









Site Name: OMP13

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341951.38E 6611826.29N

Orientation: 90/180

Community: W-C

Landform Type: Flat/Open Depression

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Comments: Isolated Banksia menziesii and B. attenuata surrounding quadrat, coming from

adjacent Banksia woodland.

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341961	6611828	
Corner 2	341963	6611816	
Corner 3	341951	6611817	

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Alexgeorgea nitens	0.1	0.1
Anigozanthos pulcherrimus	0.2	0.1
Austrostipa compressa	0.1	0.1
Babingtonia urbana (P3)	9	1
Banksia attenuata		
Banksia menziesii		
Banksia platycarpa	0.5	0.3
Banksia prionotes		
Banksia telmatiaea	1	20
Beaufortia elegans	1	0.5
Beaufortia squarrosa	1.2	12
Burchardia congesta	0.4	0.1
Calytrix aurea	1.7	1
Chaetospora curvifolia	0.4	0.3



Comesperma calymega	0.3	0.1
Conospermum stoechadis subsp. stoechadis		
Conostylis aculeata subsp. spinuligera	0.3	0.1
Conostylis juncea	0.2	0.1
Daviesia incrassata	0.4	0.6
Eremaea asterocarpa subsp. asterocarpa		0.1
Hakea obliqua subsp. parviflora	1.4	1.5
Hibbertia crassifolia	0.4	0.1
Hibbertia subvaginata	0.4	0.1
Hypocalymma xanthopetalum	0.2	0.1
*Hypochaeris glabra	0.1	0.1
Jacksonia hakeoides	0.4	0.9
Jacksonia nutans	0.6	0.3
Leucopogon oldfieldii	0.5	0.5
Lyginia imberbis	0.3	0.1
Lysinema pentapetalum	0.4	0.3
Melaleuca seriata	1	2
Philotheca spicata	0.1	0.2
Podotheca gnaphalioides	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Stirlingia latifolia	0.3	0.2
Stylidium repens	0.1	0.1
Thysanotus thyrsoideus	0.5	0.1
*Wahlenbergia capensis	0.2	0.1
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Site Name: OMP14

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341516.2532E 6612093.188N

Orientation: 180/270

Community: W-D

Landform Type: Flat/Open Depression

Slope Class: Level (0 degrees)

Soil Type: Sandy Clay Loam

Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 3 - Very Good

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	341517	6612085	
Corner 2	341507	6612084	
Corner 3	341507	6612096	

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa		
*Aira caryophyllea subsp. caryophyllea	0.1	0.2
Allocasuarina lehmanniana subsp.	2.3	2
lehmanniana		
?Angianthus tomentosus	0.1	0.1
*Avellinia festucoides	0.1	0.1
Banksia nivea subsp. nivea		
Banksia telmatiaea	1.5	10
Caladenia flava subsp. flava	0.2	0.1
Caladenia longicauda subsp. albella	0.3	0.1
Calandrinia granulifera		
Calandrinia sp. Kenwick (G.J. Keighery		
10905)		
Cassytha racemosa forma pilosa		0.1
Centrolepis polygyna	0.1	0.1
Chaetanthus aristatus	0.5	0.2



Clematis linearifolia		
Cotula cotuloides		
Crassula closiana		
Crassula colorata var. acuminata		
Crassula exserta	0.1	0.1
Euchiton sphaericus	0.1	0.1
Hakea varia	1	0.6
Homalosciadium homalocarpum	0.1	0.1
Hydrocotyle alata		
*Hypochaeris glabra	0.1	0.2
*Isolepis marginata	0.1	0.1
*Lysimachia arvensis	0.1	0.2
Melaleuca brevifolia	1	3
Melaleuca rhaphiophylla	0.9	1
Melaleuca teretifolia	1	0.3
Melaleuca viminea subsp. viminea	2	2.5
Millotia myosotidifolia	0.1	0.1
Olearia axillaris		
*Pentameris airoides subsp. airoides	0.1	0.2
Phyllangium divergens	0.1	0.1
Podotheca gnaphalioides	0.1	0.1
Regelia ciliata	1	1
Rhagodia baccata subsp. baccata	0.9	0.8
*Sagina apetala	0.1	0.1
Scaevola repens var. repens	0.1	0.1
Senecio pinnatifolius var. latilobus	0.1	0.1
*Sonchus oleraceus	0.2	0.1
Spergularia brevifolia	0.1	0.1
Thysanotus manglesianus		0.1
*Ursinia anthemoides subsp. anthemoides	0.1	0.1
*Vulpia myuros forma myuros	0.2	0.1
Wahlenbergia preissii	0.1	0.1







Site Name: COOL45

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 12/03/2008

GPS Location: GDA94 Zone 50 340448E 6613715N

Community: W-C

Landform Type: Swamp

Slope Class: Flat

Soil Type: Sand

Soil Colour: Grey/brown

Fire: 4

Comments: Heath/thicket (occasional Banksia littoralis)

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.8	10
Austrostipa sp.	0.2	0.1
Banksia telmatiaea	0.8	30
Cassytha glabella forma bicallosa		0.1
Conostylis ?aculeata	0.3	1
Cyathochaeta ?avenacea	0.3	1
Desmocladus ?flexuosus	0.3	0.5
Glischrocaryon aureum	0.6	0.1
Hakea obliqua subsp. parviflora	1	0.1
Hibbertia racemosa	0.3	0.1
Hypocalymma angustifolium	1	0.4
Laxmannia ramosa subsp. ramosa	0.3	0.1
Lepidosperma longitudinale	0.6	1
Leucopogon sp. Lesueur (B. Evans 530)	0.4	0.1
Olax scalariformis	0.4	0.1
Pimelea imbricata var. ?piligera	0.3	0.1
Regelia ciliata	1	50
Scaevola ?lanceolata	0.3	0.3
Schoenus subfascicularis	0.7	0.1
Stylidium repens	0.1	0.1
Verticordia densiflora var. densiflora	0.3	0.1
Viminaria juncea	2	10







Site Name: COOL55

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 11/03/2008

GPS Location: GDA94 Zone 50 341391E 6613043N

Community: D-A

Landform Type: Midslope

Slope Class: Very gentle

Soil Type: Sand

Soil Colour: Brown

Fire: >7

Comments: Woodland with occasional *Eucalyptus todtiana*

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	0.3	0.1
Alexgeorgea nitens	0.3	0.5
Amphipogon turbinatus	0.2	0.1
Arnocrinum preissii	0.5	0.1
<i>Austrostipa</i> sp.	0.2	0.1
Banksia attenuata	4	10
Banksia dallanneyi subsp. dallanneyi	0.3	0.1
Banksia menziesii	4	1
Bossiaea eriocarpa	0.4	1.5
Conostephium pendulum	0.4	0.1
Dasypogon obliquifolius	0.4	5
Eremaea asterocarpa subsp. asterocarpa	0.4	1
Gompholobium tomentosum	0.4	0.1
Hibbertia ?crassifolia	0.5	0.3
Hibbertia hypericoides	0.6	8
Hibbertia ?sp. Gnangara (J.R. Wheeler 2329)	0.4	0.2
Hypocalymma xanthopetalum	0.4	0.1
Jacksonia floribunda	0.8	0.5
Jacksonia nutans	0.8	0.5
Lepidobolus preissianus	0.3	0.1
Lepidosperma pubisquameum	0.3	0.4
Lomandra hermaphrodita	0.2	0.1
Lyginia imberbis	0.3	0.1
Melaleuca clavifolia	0.5	0.5
Mesomelaena pseudostygia	0.3	0.6
Patersonia occidentalis var. occidentalis	0.4	1.5
Petrophile linearis	0.6	0.2



Phlebocarya ciliata	0.3	0.1
Phlebocarya filifolia	0.3	0.4
Scaevola repens var. repens	0.1	0.1
Schoenus clandestinus	0.1	0.3
Schoenus curvifolius	0.3	0.1
Schoenus ?pedicellatus	0.3	0.1
Stirlingia latifolia	0.4	0.5
Stylidium repens	0.1	0.1
Stylidium sp.	0.1	0.1
Xanthorrhoea preissii	1	1.5
Xanthosia huegelii	0.1	0.1





Site Name: COOL58

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 11/03/2008

GPS Location: GDA94 Zone 50 340876E 6613112N

Community: W-C

Landform Type: Swamp

Slope Class: Flat

Soil Type: Silty sand

Soil Colour: Brown

Fire: 5

Comments: Thicket

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea	0.3	15
Cassytha glabella forma bicallosa		0.1
Chaetanthus aristatus	0.5	20
Desmocladus ?flexuosus	0.3	2
Glischrocaryon aureum	0.1	0.1
Hakea obliqua subsp. parviflora	1	0.2
Hibbertia racemosa	0.3	0.1
Melaleuca preissiana	1.5	0.5
Pericalymma spongiocaule	0.5	0.1
Petrophile brevifolia	0.2	0.1
Regelia ciliata	1	30
Viminaria juncea	2	30







Site Name: COO-01

Site Type: QUADRAT

Survey Date: 01/11/2006

GPS Location: WGS84 Zone 50 345362E 6608699N

Community: W-A

Fire: >5

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. pulchella	0.4	0.1
*Aira cupaniana	0.1	0.1
Banksia telmatiaea	0.4	0.2
Blennospora drummondii	0.1	0.1
*Briza maxima	0.2	0.2
*Briza minor	0.2	0.2
Eryngium pinnatifidum subsp. Palustre (G.J.	0.3	0.1
Keighery 13459) (P3)		
Haemodorum ?spicatum	0.2	0.1
Hakea lissocarpha	1	1.5
Hakea varia	1.2	0.5
*Hypochaeris glabra	0.1	0.01
Lepidosperma pubisquameum	0.2	0.1
Meeboldina cana	0.4	10
Melaleuca seriata	0.3	0.5
Melaleuca viminea subsp. viminea	0.9	30
Opercularia vaginata	0.2	0.2
*Ornithopus compressus	0.1	0.1
Patersonia occidentalis	0.3	0.3
Podolepis gracilis	0.1	0.2
Pogonolepis stricta	0.05	0.1
Polypogon tenellus	0.1	0.1
Verticordia densiflora var. densiflora	1	5
Viminaria juncea	2	0.3







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 26/10/2012

GPS Location: WGS84 Zone 50 339449E 6613634N

Orientation: 90o/180o from GPS point

Community: W-D

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Disturbance: None

Fire: >10 years

Habitat: Mid open shrubland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea	1.1	3
Cassytha glabella forma dispar	1	0.5
Centrolepis aristata	0.1	0.1
Chaetanthus aristatus	0.3	0.2
Crassula colorata var. acuminata	0.1	0.1
Goodenia pulchella subsp. Coastal Plain A	0.1	0.2
(M. Hislop 634)		
*Hypochaeris glabra	0.1	0.1
Melaleuca brevifolia	0.8	2
Melaleuca viminea subsp. viminea	1.2	15
Regelia ciliata	1.1	2







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 20/11/2012

GPS Location: WGS84 Zone 50 343726E 6611242N

Orientation: 90o/180o from GPS point

Community: D-A

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: SE

Soil Type: Sand

Soil Colour: Orange

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Disturbance: None

Fire: <5 years

Habitat: Low open woodland over low shrubland

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. reflexa	0.8	2
Allocasuarina humilis		0.8
Amphipogon turbinatus	0.3	0.1
Anigozanthos humilis subsp. humilis	0.2	0.2
Arnocrinum preissii	0.3	0.1
Banksia attenuata	3	12
Banksia dallanneyi subsp. dallanneyi	0.2	2
Banksia menziesii		0.3
Banksia telmatiaea	0.6	2
Boronia ramosa subsp. anethifolia	0.2	0.3
Bossiaea eriocarpa	0.3	0.3
Cassytha glabella forma dispar		0.2
Conospermum stoechadis subsp. stoechadis	1	15
Eremaea pauciflora	0.3	5
Gompholobium tomentosum	0.2	0.1
Hakea costata	1.1	5
Hemiandra linearis	0.3	0.1
Hibbertia huegelii	0.3	0.2
Hibbertia subvaginata	0.4	0.1



Jacksonia nutans	1.3	10
Melaleuca clavifolia	0.4	0.5
Mesomelaena pseudostygia	0.4	0.1
Nuytsia floribunda	1.5	1
Patersonia occidentalis var. ?occidentalis	0.3	0.8
Podotheca gnaphalioides	0.1	0.1
Schoenus clandestinus	0.1	0.1
Stackhousia ?monogyna	0.4	0.2
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides	0.1	0.1
*Vulpia sp.	0.1	0.1
*Wahlenbergia capensis	0.1	0.1
Wahlenbergia gracilenta	0.1	0.1
Waitzia suaveolens var. suaveolens	0.1	0.2
Xanthorrhoea preissii	1.1	1





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 08/11/2012

GPS Location: GDA94 Zone 50 341908E 6612622N

Orientation: Cardinal points

Community: D-A

Landform Type: Flat

Slope Class: Level (0 degrees)

Aspect: W

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Habitat: Banksia woodland

Taxon Name	Avg. Height	Cover Alive
Amphipogon turbinatus	0.05	0.1
Austrostipa macalpinei	0.2	0.1
Banksia attenuata	3.5	25
Banksia dallanneyi subsp. dallanneyi	0.15	0.5
Banksia menziesii	3	5
Bossiaea eriocarpa	0.4	7
Conostylis ?aurea	0.3	0.5
Conostylis aurea	0.4	0.5
Dasypogon obliquifolius	0.7	4
Drosera eneabba	0.01	0.1
Eremaea asterocarpa subsp. asterocarpa	0.5	1.5
Eucalyptus todtiana	0.1	0.1
Hakea obliqua subsp. parviflora	0.4	0.1
Hibbertia crassifolia	0.3	0.5
Hypocalymma xanthopetalum	0.4	0.5
Jacksonia hakeoides	0.5	1
Jacksonia nutans	0.5	0.5
Lepidosperma pubisquameum	0.3	0.1
Leucopogon conostephioides	0.1	0.1
Melaleuca clavifolia	0.4	0.5
Petrophile linearis	0.3	0.5
Phlebocarya ciliata	0.3	0.5



Dhullan aium divoraons	0.05	0.1
Phyllangium divergens	0.05	U.1
Podotheca angustifolia	0.05	0.5
Poranthera drummondii	0.02	0.1
Pterochaeta paniculata	0.05	0.1
Rytidosperma ?occidentale	0.2	0.1
Scaevola repens var. repens	0.1	0.1
Stylidium adpressum	0.05	0.5
Stylidium diuroides subsp. diuroides	0.1	0.5
Stylidium rigidulum	0.05	0.1
Trachymene pilosa	0.1	0.5
Waitzia acuminata var. albicans	0.1	0.5
Xanthorrhoea preissii	2	2
Xanthosia huegelii	0.1	0.1
•		





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 08/11/2012

GPS Location: GDA94 Zone 50 342918E 6612030N

Orientation: Cardinal points

Community: W-E

Landform Type: Low dune/rise on plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: NE

Soil Type: Sandy Loam

Soil Colour: Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Habitat: Regelia heath

Taxon Name	Avg. Height	Cover Alive
Austrostipa macalpinei	0.15	0.1
Banksia telmatiaea	1.5	20
Calothamnus quadrifidus subsp. quadrifidus	0.5	0.1
Conostylis aculeata subsp. spinuligera	0.3	0.5
Hypocalymma angustifolium	0.15	0.1
Melaleuca rhaphiophylla	2.5	5
Regelia ciliata	2	50
Schoenus rigens	0.2	0.1
Schoenus subfascicularis		
Trachymene pilosa	0.03	0.1
Xanthorrhoea preissii	0.4	0.5







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/11/2012

GPS Location: GDA94 Zone 50 344175E 6610906N

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Orange-Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Habitat: Banksia telmatiaea heath.

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.7	1
Banksia dallanneyi subsp. dallanneyi	0.1	0.5
Banksia telmatiaea	1.5	40
Conostylis aculeata subsp. spinuligera	0.3	1
Daviesia incrassata subsp. incrassata	0.4	0.1
Hakea obliqua subsp. parviflora	2.5	4
Hakea prostrata	0.4	1
Hibbertia subvaginata	0.2	0.1
Isopogon panduratus subsp. palustris (P3)	0.7	0.1
Jacksonia nutans	0.5	0.5
Lepidosperma ?pubisquameum	0.3	0.5
Melaleuca seriata	0.4	0.5
Regelia ciliata	1.7	7
Schoenus rigens	0.15	0.1
Schoenus subfascicularis	0.4	0.5
Trachymene pilosa	0.04	0.1







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/11/2012

GPS Location: GDA94 Zone 50 345516E 6609455N

Orientation: Cardinal points

Community: W-E

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Loam

Soil Colour: dark brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: weeds and rabbits

Habitat: Open dampland

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.4	0.5
Acacia saligna subsp. lindleyi ms	1.6	0.5
*Aira cupaniana	0.05	0.5
Amphipogon turbinatus	0.05	0.1
Austrostipa macalpinei	0.15	0.1
Banksia telmatiaea	1.6	3
*Briza maxima	0.05	0.5
*Briza minor	0.05	0.1
Centrolepis pilosa	0.03	0.25
Centrolepis polygyna	0.03	0.25
Conostylis aculeata subsp. spinuligera	0.3	0.5
Exocarpos sparteus	1.7	0.5
Hakea trifurcata	1.2	4
*Hypochaeris glabra	0.1	1
Lepidosperma ?pubisquameum	0.4	0.5
Melaleuca rhaphiophylla	1.5	7
Melaleuca teretifolia	1.5	5
?Microtis sp.	0.15	0.1
*Parentucellia latifolia	0.05	0.1
*Pentameris airoides	0.1	0.5
Podolepis gracilis	0.2	1
Podotheca angustifolia	0.15	0.5



Pogonolepis stricta	0.03	0.1
Poranthera drummondii		
Ptilotus polystachyus	0.3	0.1
Schoenus subfascicularis	0.3	0.1
Siloxerus humifusus	0.01	1
*Sonchus oleraceus	0.4	0.1
Trachymene pilosa	0.1	0.5
*Ursinia anthemoides	0.1	0.5
* <i>Vulpia</i> sp.	0.2	1
Xanthorrhoea preissii	1	0.5





Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 07/11/2012

GPS Location: GDA94 Zone 50 346203E 6608881N

Orientation: Cardinal points

Community: D-B

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: yellow / brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Habitat: Banksia prionotes woodland

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 2: Banksia prionotes

Mid Stratum 1: Allocasuarina humilis, Hakea trifurcata

Mid Stratum 2: Hakea costata, Hibbertia hypericoides, Petrophile recurva

Lower Stratum 1: Lepidobolus preissianus subsp. preissianus

Lower Stratum 2: Pterochaeta paniculata

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. reflexa	0.05	0.1
Allocasuarina humilis	2	10
Amphipogon turbinatus	0.05	0.1
Anigozanthos humilis subsp. humilis	0.1	0.1
Austrostipa macalpinei	0.15	0.1
Banksia dallanneyi subsp. dallanneyi	0.1	0.5
Banksia prionotes	4	5
Burchardia congesta	0.3	0.1
Calytrix fraseri		
Cassytha glabella forma dispar	0.2	0.1
Caustis dioica	0.2	0.5
Conospermum stoechadis subsp. stoechadis	0.5	0.5
Conostylis ?aurea	0.15	0.5
Conostylis teretifolia subsp. teretifolia	0.05	0.1
Dasypogon obliquifolius	0.3	0.5



Daviesia incrassata subsp. incrassata	0.4	0.1
Drosera erythrorhiza subsp. ?magna	0.01	0.5
Hakea costata	1	1
Hakea ruscifolia	1.5	0.5
Hakea trifurcata	2	40
Hibbertia crassifolia	0.2	0.1
Hibbertia huegelii	0.3	0.5
Hibbertia hypericoides	0.5	4
Hypocalymma xanthopetalum	0.3	0.5
*Hypochaeris glabra	0.01	0.1
Isotropis cuneifolia subsp. cuneifolia	0.2	0.5
Jacksonia hakeoides	0.4	0.5
Laxmannia sessiliflora subsp. ?australis	0.1	0.5
Lepidobolus preissianus subsp. preissianus	0.2	0.5
Lepidosperma aff. scabrum	0.3	0.5
Leucopogon parviflorus	1	0.5
Leucopogon sprengelioides	0.3	0.5
Lomandra hermaphrodita	0.2	0.1
Melaleuca clavifolia	0.6	0.5
Mesomelaena pseudostygia	0.4	1
Neurachne alopecuroidea	0.4	0.5
Opercularia vaginata	0.15	0.5
Patersonia occidentalis var. ?occidentalis	0.5	0.5
Petrophile macrostachya	0.4	1
Petrophile recurva	1.5	7
Pterochaeta paniculata	0.03	0.5
Rytidosperma sp.		
Scaevola canescens	0.15	0.5
Schoenus clandestinus	0.01	0.5
Stirlingia latifolia	0.5	0.5
Stylidium adpressum	0.03	1
Stylidium crossocephalum	0.1	0.1
Stylidium purpureum	0.2	0.1
Thysanotus spiniger	0.2	0.1
Trachymene pilosa	0.03	0.1
Tricoryne ?elatior	0.2	0.1
*Wahlenbergia capensis	0.1	0.5
Waitzia acuminata var. albicans	0.05	0.1
Xanthorrhoea preissii	2	







Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2013

GPS Location: WGS84 Zone 50 345809E 6606833N

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: grey / brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Disturbance: None

Habitat: Regelia heath

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. reflexa	0.4	0.5
Alexgeorgea nitens	0.05	1
Baeckea sp. Perth Region (R.J. Cranfield 444)	0.5	0.5
Banksia dallanneyi subsp. dallanneyi	0.25	1
Banksia telmatiaea	1.2	4
Cassytha glabella forma dispar	1	0.5
Chordifex chaunocoleus (P4)	0.25	1
Conospermum stoechadis subsp. stoechadis	0.75	0.1
Conostylis juncea	0.2	0.1
Daviesia decurrens	0.3	0.5
Harperia lateriflora	0.2	0.5
Hibbertia stellaris	0.25	0.5
Hibbertia subvaginata	0.25	0.5
Hypocalymma angustifolium	0.25	0.5
Leucopogon sprengelioides	0.4	0.5
Melaleuca brevifolia	1.2	2
Melaleuca seriata	0.3	0.5
Regelia ciliata	1.5	80
Schoenus brevisetis	0.25	0.5
Schoenus subfascicularis	0.3	0.1
Verticordia densiflora var. densiflora	0.5	0.1







Site Name: NEW121

Site Type: QUADRAT

Dimensions: 10m x 10m

Survey Date: 19/10/2012

GPS Location: WGS84 Zone 50 347445E 6607167N

Community: D-A

Landform Type: Mid Slope

Slope Class: Very Gently Inclined (1 degree)

Aspect: S

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 1 - Pristine

Disturbance: None

Habitat: Banksia woodland

Taxon Name	Avg. Height	Cover Alive
Acacia sphacelata subsp. verticillata	0.25	0.5
Adenanthos cygnorum subsp. cygnorum	2	1
Alexgeorgea nitens	0.05	0.5
Amphipogon turbinatus	0.4	0.5
Anigozanthos humilis subsp. humilis	0.15	0.5
Astroloma microdonta	0.05	0.1
Austrostipa macalpinei	0.15	0.5
Banksia attenuata	4	10
Banksia menziesii	3	5
Boronia ramosa subsp. anethifolia	0.25	0.1
Bossiaea eriocarpa	0.3	0.5
Calytrix flavescens	0.3	1
Calytrix ?fraseri	0.3	0.1
Cassytha glabella forma dispar	0.3	0.5
Conospermum stoechadis subsp. stoechadis	0.4	0.1
Conostephium pendulum	0.4	0.5
Conostylis aurea	0.25	0.5
Dasypogon obliquifolius	0.7	2
Drosera eneabba	0.05	0.5
Drosera ?menziesii	0.2	0.5
Eremaea asterocarpa subsp. asterocarpa	0.5	0.5
Eremaea pauciflora	1.5	20



Hibbertia crassifolia	0.35	0.5
Hibbertia huegelii	0.3	0.5
Hibbertia hypericoides	0.5	1
Hibbertia subvaginata	0.2	0.5
Hypocalymma xanthopetalum	0.25	0.5
Isotropis cuneifolia subsp. cuneifolia	0.03	0.1
Jacksonia nutans	0.7	0.5
Lasiopetalum lineare	0.05	0.1
Lepidosperma pubisquameum	0.4	0.5
Leucopogon sprengelioides	0.4	0.5
Lomandra hermaphrodita	0.15	0.5
Lomandra preissii	0.3	0.1
Lyginia barbata	0.5	0.5
Melaleuca clavifolia	0.4	2
Patersonia occidentalis var. ?occidentalis	0.8	4
Petrophile linearis	0.6	1
Phyllangium divergens	0.02	0.1
Pileanthus filifolius	0.5	0.5
Schoenus curvifolius	0.3	0.5
Schoenus griffinianus (P4)	0.05	0.5
Schoenus ?subfascicularis	0.5	0.5
Scholtzia involucrata	0.7	1
Stirlingia latifolia	1	0.5
Stylidium adpressum	0.03	0.5
Stylidium crossocephalum	0.1	0.1
Synaphea spinulosa subsp. spinulosa	0.3	0.5
Thysanotus thyrsoideus	0.4	0.5
Trachymene pilosa	0.03	0.5
*Wahlenbergia capensis	0.25	0.5
Xanthorrhoea preissii	0.6	0.1
Xanthosia huegelii	0.05	0.5







RELEVÉS

Site Name: LFGS07

Site Type: RELEVE

Survey Date: 19/10/2022

GPS Location: GDA94 Zone 50 340204.7981E 6613871.292N

Community: W-C

Landform Type: Low Rise/Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: S

Soil Type: Sandy Loam
Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall isolated heath shrubs over mid heathland over low heathland

SITE POINTS

Label	Easting	Northing	Comments
Corner 1	340204	6613861	SW Corner
Corner 2	340212	6613860	SE Corner
Corner 3	340213	6613869	NE Corner

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. glaberrima	0.4	0.2
Actinotus leucocephalus	0.15	0.1
Adenanthos cygnorum subsp. cygnorum	2.4	10
Anigozanthos humilis subsp. humilis	0.15	0.1
Austrostipa compressa	0.2	0.1
Banksia attenuata	2	1
Banksia menziesii		
Banksia nivea subsp. nivea	0.1	0.5
Banksia telmatiaea	0.8	9
Bossiaea eriocarpa	0.3	0.5
Burchardia multiflora	0.35	0.1
Calytrix flavescens	0.15	0.1
Chaetospora curvifolia	0.45	0.1
Conostephium pendulum	0.3	0.5



Drosera ?menziesii	0.45	0.1
Eremaea beaufortioides var. beaufortioides	1.6	5
Hakea obliqua subsp. parviflora	2	8
Hibbertia crassifolia	0.3	0.5
Hibbertia hypericoides subsp. hypericoides	0.5	4
Hibbertia pubens	0.3	1
Hypocalymma quadrangulare (P3)	0.3	0.1
*Hypochaeris glabra	0.1	0.1
Isopogon panduratus subsp. palustris (P3)		
Jacksonia nutans	0.8	4
Leucopogon oldfieldii	0.35	1
Patersonia occidentalis var. occidentalis	0.25	0.1
Petrophile linearis		
Philotheca spicata		
Poranthera asybosca (P1)		
Pterochaeta paniculata	0.05	0.1
Pyrorchis nigricans	0.01	0.1
Scholtzia sp. Wongonderrah (M.E. & M.R.	2.1	4
Trudgen MET 12000)		
Stirlingia latifolia	0.35	0.1
Stylidium calcaratum		
Stylidium rigidulum	0.1	0.1
Stylidium spiciforme		
Styphelia ?xerophylla	0.2	0.1
Synaphea spinulosa subsp. spinulosa		
Thysanotus thyrsoideus	0.45	0.1
Trachymene pilosa	0.05	0.1
Xanthosia huegelii	0.15	0.1









Site Name: LFGSR01
Site Type: RELEVE

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 343458.2975E 6611260.369N

Community: D-A

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: N

Soil Type: Loamy Sand

Soil Colour: Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Sparse herbaceous weeds

Fire: >5 Years

Habitat: Low isolated clumps of trees of Banksia attenuata and Banksia menziesii over

mid heathland over low open heathland

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Calothamnus quadrifidus subsp.		
angustifolius		
Conospermum stoechadis subsp. stoechadis		
Eremaea pauciflora var. pauciflora		
Hibbertia hypericoides subsp. hypericoides		
Melaleuca seriata		
Regelia ciliata		









Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339978.1655E 6613225.246N

Community: D-A

Landform Type: Low Rise

Slope Class: Gently Inclined (3 degrees)

Aspect: SE

Soil Type: Loamy Sand

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid isolated clumps of shrubs over low isolated

shrubs over low isolated clumps of forbs

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Calothamnus quadrifidus subsp.		
angustifolius		
Hibbertia hypericoides subsp. hypericoides		
Trachymene pilosa		









Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339789.4095E 6614034.091N

Community: W-D

Landform Type: Undulating Plain/Open Depression

Slope Class: Level (0 degrees)

Soil Type: Sandy Clay

Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: None

Fire: >5 Years

Habitat: Mid open heathland over low open heathland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Melaleuca acutifolia		
Melaleuca brevifolia		
Melaleuca viminea subsp. viminea		
Regelia ciliata		









Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 340887.92E 6613117.75N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Orange

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid heathland over low sparse heathland

Comments: Existing quadrat COOL58

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Kunzea micrantha subsp. petiolata		
Melaleuca brevifolia		
Regelia ciliata		









Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340194.29E 6613447.96N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall isolated heath shrubs over mid heathland over low heathland

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Isopogon panduratus subsp. palustris (P3)		
Leucopogon oldfieldii		
Melaleuca seriata		
Regelia ciliata		
Verticordia densiflora var. densiflora		









Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340462.5685E 6613697.834N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: SW

Soil Type: Sandy Loam

Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid closed heathland over sparse low heathland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Isopogon panduratus subsp. palustris (P3)		
Melaleuca seriata		
Regelia ciliata		
Verticordia densiflora var. densiflora		









Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340753.8979E 6612575.971N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid open heathland over low heathland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Cassytha racemosa		
Hakea obliqua subsp. parviflora		
Kunzea micrantha subsp. petiolata		
Melaleuca seriata		
Regelia ciliata		
Verticordia densiflora var. densiflora		









Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 340785.7827E 6613007.928N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Orange

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall isolated heath shrubs over mid sparse heathland over low heathland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Melaleuca seriata		
Regelia ciliata		









Site Type: RELEVE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 341319.858E 6612576.331N

Community: D-A

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid sparse shrubland over low open shrubland

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia menziesii		
Eremaea asterocarpa subsp. asterocarpa		
Hibbertia hypericoides subsp. hypericoides		
Jacksonia nutans		
Leucopogon oldfieldii		
Melaleuca seriata		
Patersonia occidentalis var. occidentalis		









Site Type: RELEVE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 341410.3397E 6612566.132N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Level (0 degrees)

Soil Type: Sandy Loam

Soil Colour: Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid closed heathland over sparse low heathland

Taxon Name	Avg. Height	Cover Alive
Banksia platycarpa		
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Isopogon panduratus subsp. palustris (P3)		
Melaleuca seriata		
Regelia ciliata		









Site Name: OLF02

Site Type: RELEVE

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 345842.36E 6608713.63N

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Brown

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid open shrubland over low shrubland.

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Melaleuca seriata, Melaleuca viminea subsp. viminea

Lower Stratum 1: Banksia telmatiaea, Hypocalymma suave

Taxon Name	Avg. Height	Cover Alive
Banksia nivea subsp. nivea		
Banksia telmatiaea		
Dampiera lindleyi		
Hypocalymma suave		
Jacksonia hakeoides		
Melaleuca seriata		
Melaleuca viminea subsp. viminea		
Sowerbaea laxiflora		
Synaphea spinulosa subsp. spinulosa		
Verticordia densiflora var. densiflora		
Xanthorrhoea preissii		







Site Name: OLF14

Site Type: RELEVE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 344570.2E 6610490.88N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid closed shrubland

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1: Banksia telmatiaea, Regelia ciliata

Taxon Name	Avg. Height	Cover Alive
*Arctotheca calendula		
Banksia telmatiaea		
Conostylis aculeata subsp. spinuligera		
Hakea obliqua subsp. parviflora		
Hibbertia subvaginata		
Isopogon panduratus subsp. palustris (P3)		
Melaleuca seriata		
Regelia ciliata		







Site Name: OLF18

Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339564.6855E 6613280.413N

Community: W-D

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sand

Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Mid shrubland over low open shrubland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea varia		
Melaleuca rhaphiophylla		
Melaleuca viminea subsp. viminea		
Regelia ciliata		







Site Name: OLF19

Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339594.51E 6613416N

Community: W-C

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall shrubland over mid open shrubland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Eremaea pauciflora var. pauciflora		
Hakea obliqua subsp. parviflora		
Hibbertia hypericoides subsp. hypericoides		
Hypocalymma quadrangulare (P3)		
Jacksonia hakeoides		
Melaleuca clavifolia		







Site Name: OLF22

Site Type: RELEVE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 342038.3959E 6612346.637N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Orange/Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid open shrubland.

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Conospermum stoechadis subsp. stoechadis		
Eremaea asterocarpa subsp. asterocarpa		
Hibbertia subvaginata		
Jacksonia hakeoides		
Melaleuca seriata		
Stirlingia latifolia		
Xanthorrhoea preissii		







Site Type: RELEVE

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 344171.9255E 6610856.524N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey/Brown

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over mid open shrubland

Comments: <100 m Banksia woodland - surrounded by heathland.

Taxon Name	Avg. Height	Cover Alive
Banksia menziesii		
Banksia telmatiaea		
Calothamnus quadrifidus subsp.		
angustifolius		
Melaleuca rhaphiophylla		
Nuytsia floribunda		
Xanthorrhoea preissii		









Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 342556.3132E 6611610.534N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall isolated shrubs over mid shrubland.

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Melaleuca seriata		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341309.74E 6613139.82N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Brown/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low open woodland over tall open shrubland over mid open shrubland.

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Eremaea beaufortioides var. beaufortioides		
Hakea obliqua subsp. parviflora		
Hypocalymma balbakiae		
Melaleuca seriata		
Xanthorrhoea preissii		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341198.1692E 6613162.456N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Light Brown

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low isolated trees over mid shrubland

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Beaufortia squarrosa		
Isopogon panduratus subsp. palustris (P3)		
Pericalymma ellipticum var. floridum		
Xanthorrhoea preissii		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341076.7006E 6613192.596N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Pale Yellow

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low isolated trees over low open shrubland

Taxon Name	Avg. Height	Cover Alive
Banksia menziesii		
Banksia prionotes		
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Isopogon panduratus subsp. palustris (P3)		
Melaleuca seriata		
Pericalymma ellipticum var. floridum		
Stirlingia latifolia		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341412.296E 6613202.635N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

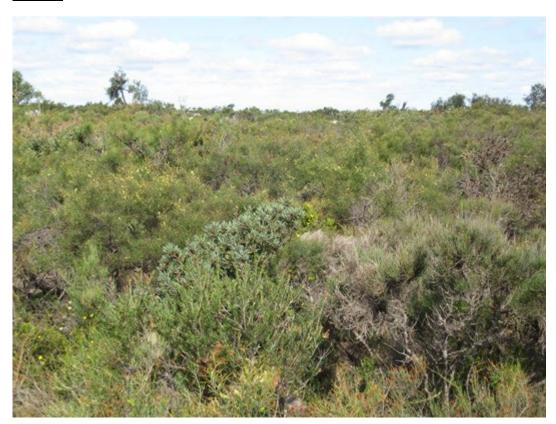
Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Low isolated trees cover mid shrubland.

Taxon Name	Avg. Height	Cover Alive
Allocasuarina humilis		
Banksia telmatiaea		
Hakea trifurcata		
Hibbertia hypericoides subsp. hypericoides		
Isopogon panduratus subsp. palustris (P3)		
Jacksonia hakeoides		
Nuytsia floribunda		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341470.99E 6613215.69N

Community: D-B

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey/Brown

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Habitat: Low isolated trees over mid shrubland.

Taxon Name	Avg. Height	Cover Alive
Allocasuarina humilis		
Conospermum stoechadis subsp. stoechadis		
Eremaea pauciflora var. pauciflora		
Hakea trifurcata		
Hibbertia hypericoides subsp. hypericoides		
Jacksonia hakeoides		
Nuytsia floribunda		
Stirlingia latifolia		







Site Type: RELEVE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341406.62E 6613256.32N

Community: W-B

Landform Type: Open Depression

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Cracking clay

Soil Colour: Yellow/Grey

Soil Condition: Dry

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Habitat: Tall open shrubland over low open shrubland

Comments: No Banksias to North or East for a long distance. Original VT mapping incorrect.

Taxon Name	Avg. Height	Cover Alive
Banksia nivea subsp. nivea		
Banksia telmatiaea		
Calothamnus hirsutus		
Isopogon panduratus subsp. palustris (P3)		
Melaleuca acutifolia		
Verticordia plumosa var. brachyphylla		







Site Type: RELEVE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 342872.3224E 6610869.029N

Community: W-C

Landform Type: Plain

Slope Class: Very Gently Inclined (1 degree)

Soil Type: Sandy Loam

Soil Colour: Grey

Soil Condition: Moist

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >5 Years

Habitat: Tall sparse shrubland over mid shrubland.

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Regelia ciliata		
Verticordia densiflora var. densiflora		







Site Name: ROMP01

Site Type: RELEVE

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 347202.76E 6606559.23N

Community: W-A

Landform Type: Open Depression

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Brown/Black

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

Taxon Name	Avg. Height	Cover Alive
Babingtonia urbana (P3)		
Crassula exserta		
Drosera glanduligera		
Exocarpos sparteus		
*Hypochaeris glabra		
Lepidosperma longitudinale		
*Lysimachia arvensis		
Melaleuca lateritia		
Melaleuca rhaphiophylla		
Melaleuca teretifolia		
Panaetia lessonii		
*Pentameris airoides subsp. airoides		
Scaevola repens var. repens		
Stylidium divaricatum		
Tribonanthes variabilis		
*Ursinia anthemoides subsp. anthemoides		
Verticordia densiflora var. densiflora		
Wurmbea dioica subsp. alba		















Site Name: ROMP02

Site Type: RELEVE

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 346908.24E 6606897.05N

Community: W-A

Landform Type: Open Depression

Slope Class: Level (0 degrees)

Soil Type: Clay Loam

Soil Colour: Brown/Black

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

Taxon Name	Avg. Height	Cover Alive
Babingtonia urbana (P3)		
Centrolepis aristata		
Conostylis aculeata subsp. breviflora		
Drosera glanduligera		
Goodenia micrantha		
Hydrocotyle alata		
*Hypochaeris glabra		
Leptocarpus canus		
Melaleuca preissiana		
Melaleuca rhaphiophylla		
Melaleuca teretifolia		
Patersonia occidentalis var. occidentalis		
Philydrella pygmaea subsp. pygmaea		
Quinetia urvillei		
Scaevola repens var. repens		
Stylidium androsaceum		
Tribonanthes variabilis		
*Ursinia anthemoides subsp. anthemoides		
Verticordia densiflora var. densiflora		
*Vulpia myuros forma myuros		-
Wurmbea dioica subsp. alba		









Site Name: ROMP03

Site Type: RELEVE

Survey Date: 05/10/2022

GPS Location: GDA94 Zone 50 344778.6E 6610419.39N

Community: D-A

Landform Type: Undulating Plain

Slope Class: Very Gently Inclined (1 degree)

Aspect: E

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

Comments: Mapped as FCT17

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella var. pulchella		
Austrostipa compressa		
Banksia attenuata		
Banksia menziesii		
Banksia nivea subsp. nivea		
Conospermum stoechadis subsp. stoechadis		
Hibbertia hypericoides subsp. hypericoides		
Hibbertia subvaginata		
Hypocalymma xanthopetalum		
*Hypochaeris glabra		
Jacksonia nutans		
Leucopogon oldfieldii		
Melaleuca clavifolia		
Melaleuca seriata		
Petrophile linearis		
Podotheca gnaphalioides		
Scaevola repens var. repens		
Siloxerus humifusus		
Stirlingia latifolia		
*Ursinia anthemoides subsp. anthemoides		
Xanthorrhoea preissii		













Site Name: ROMP04

Site Type: RELEVE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341734.93E 6611815.69N

Community: W-C

Landform Type: Flat

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Grey/Yellow

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Disturbance: Exotic Weeds - Weeds

Fire: >10 Years

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Austrostipa compressa		
Banksia menziesii		
Banksia platycarpa		
Banksia telmatiaea		
Beaufortia elegans		
Beaufortia squarrosa		
Calytrix aurea		
Conospermum stoechadis subsp. stoechadis		
Conostylis aculeata subsp. spinuligera		
Daviesia incrassata		
Hakea obliqua subsp. parviflora		
Hibbertia subvaginata		
Jacksonia hakeoides		
Leucopogon oldfieldii		
Melaleuca seriata		
Nuytsia floribunda		
Scaevola repens var. repens		
Stirlingia latifolia		
Verticordia densiflora var. densiflora		
*Wahlenbergia capensis		















Site Name: ROMP05

Site Type: RELEVE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 342053.99E 6611648.97N

Community: D-A

Landform Type: Upper Slope

Slope Class: Level (0 degrees)

Soil Type: Sand

Soil Colour: Grey

Rock Outcrop: No bedrock exposed

CF Abundance: 0%

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Fire: >10 Years

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Blennospora drummondii		
Bossiaea eriocarpa		
Burchardia congesta		
Conospermum stoechadis subsp. stoechadis		
Drosera ?drummondii		
Drosera erythrorhiza		
Hakea obliqua subsp. parviflora		
Hibbertia crassifolia		
Hibbertia hypericoides subsp. hypericoides		
Hypocalymma xanthopetalum		
*Hypochaeris glabra		
Jacksonia nutans		
Macrozamia fraseri		
Melaleuca clavifolia		
Melaleuca seriata		
Petrophile linearis		
Scaevola repens var. repens		
Siloxerus humifusus		
*Ursinia anthemoides subsp. anthemoides		
Verticordia densiflora var. densiflora		















Site Name: CW01

Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 342325E 6612530N

Community: D-A

Landform Type: Sandy rise

Slope Class: Gentle

Soil Type: Sand

Soil Colour: Grey/brown over pale yellow

Fire: >10

Comments: Woodland over heath

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	0.8	0.3
Alexgeorgea nitens	0.1	0.1
Allocasuarina humilis	1.2	1.5
Anigozanthos humilis subsp. humilis	0.3	0.1
Banksia attenuata	2	4
Banksia ilicifolia	3	4
Banksia menziesii	3	12
Blancoa canescens	0.1	0.1
Boronia ramosa subsp. anethifolia	0.2	0.1
Bossiaea eriocarpa	0.3	1
Conospermum stoechadis	1	1
Conostephium pendulum	0.6	0.1
Dasypogon obliquifolius	0.3	1
Eremaea beaufortioides	0.8	1
Eucalyptus todtiana	3	10
Gompholobium tomentosum	0.3	0.1
Gonocarpus pithyoides	0.3	0.1
Hemiphora bartlingii	0.6	0.1
Hibbertia hypericoides	1.5	25
Isotropis cuneifolia subsp. cuneifolia	0.1	0.1
Jacksonia floribunda	0.4	0.1
Jacksonia nutans		
Lepidobolus preissianus subsp. preissianus	0.3	0.1
Leucopogon conostephioides	0.4	0.1
Lyginia imberbis	0.3	0.5
Macarthuria australis	0.3	0.1
Melaleuca clavifolia	0.6	0.1
Mesomelaena pseudostygia	0.4	2
Mirbelia ?spinosa	0.3	0.1



Nuytsia floribunda	3	3
Petrophile linearis	0.5	0.2
Pimelea sulphurea	0.1	0.1
Schoenus clandestinus	0.1	0.1
Stylidium brunonianum	0.5	0.1
Stylidium crossocephalum	0.1	0.1
Stylidium cygnorum	0.1	0.1
Stylidium diuroides subsp. paucifoliatum	0.1	0.1
Stylidium repens	0.1	0.1
Thysanotus multiflorus	0.4	0.1
Verreauxia reinwardtii	1	0.2
Waitzia suaveolens var. suaveolens	0.1	0.1
Xanthosia huegelii	0.1	0.1





Site Name: CW02

Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 343514E 6611595N

Community: W-C

Landform Type: Minor basin

Soil Type: Sand

Soil Colour: Pale yellow over brown

Fire: >10

Comments: Thicket

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	1.5	15
Acacia saligna subsp. lindleyi ms	3	2
Banksia telmatiaea	0.6	1
Calytrix aurea	1.2	0.1
Conostylis aculeata subsp. spinuligera	0.1	0.1
Daviesia incrassata	1	0.1
Hibbertia subvaginata	0.3	0.1
*Hypochaeris glabra	0.1	0.1
Jacksonia nutans	0.6	0.1
Lepidosperma squamatum	0.6	0.1
Melaleuca rhaphiophylla	2	1
Olax scalariformis	0.6	0.1
Regelia ciliata	1	4
Scaevola ?lanceolata	0.4	0.1
Schoenus subfascicularis	0.4	0.1
Stackhousia monogyna	0.4	0.1
Trachymene pilosa	0.1	0.1
*Ursinia anthemoides	0.2	0.1
Verticordia densiflora	0.4	2
Viminaria juncea	3	35







Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 344410E 6610695N

Community: W-C

Landform Type: Basin

Soil Type: Sand

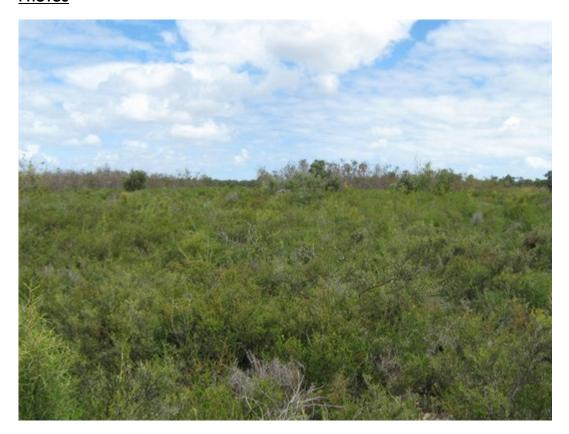
Soil Colour: Pale yellow over brown

Fire: >5

Comments: Low heath

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.6	30
Acacia saligna subsp. lindleyi ms	2	0.2
Banksia attenuata		
Banksia menziesii		
Banksia platycarpa	0.2	0.1
Banksia telmatiaea	0.5	4
Conostylis aculeata subsp. spinuligera	0.2	0.1
Daviesia incrassata	0.4	1
Gompholobium tomentosum	0.4	0.1
Hakea obliqua subsp. parviflora	1.2	1
Hibbertia subvaginata	0.2	0.1
Hypocalymma angustifolium		
Jacksonia nutans	1	3
Nuytsia floribunda	3	0.5
Regelia ciliata	0.5	0.2







Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 345377E 6609800N

Community: D-A

Landform Type: Midslope

Soil Type: Sand

Soil Colour: Grey over brown

Fire: >8

Comments: Woodland over heath

Actinotus leucocephalus 0.2 0.1 Alexgeorgea nitens 0.1 0.1 Amphipogon sp. 0.2 0.1 Banksia attenuata 3.5 10 Banksia menziesii 2.5 4 Bossiaea eriocarpa 0.4 5 Calytrix ?flavescens 0.4 0.1 Calytrix ?fraseri 1 0.3 Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius 0.4 4 Drosera parvula 0.1 0.1 Eremaea pauciflora 1.2 8 Eucalyptus todtiana 3 1 Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.4 0.1 Melaleuca ?clavifolia 0.6 3 <	Taxon Name	Avg. Height	Cover Alive
Amphipogon sp. 0.2 0.1 Banksia attenuata 3.5 10 Banksia menziesii 2.5 4 Bossiaea eriocarpa 0.4 5 Calytrix ?flavescens 0.4 0.1 Calytrix ?fraseri 1 0.3 Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius 0.4 4 Drosera parvula 0.1 0.1 Eremaea pauciflora 1.2 8 Eucalyptus todtiana 3 1 Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.1 0.1 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3	Actinotus leucocephalus	0.2	0.1
Banksia attenuata 3.5 10 Banksia menziesii 2.5 4 Bossiaea eriocarpa 0.4 5 Calytrix ?flavescens 0.4 0.1 Calytrix ?fraseri 1 0.3 Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius 0.4 4 Drosera parvula 0.1 0.1 Eremaea pauciflora 1.2 8 Eucalyptus todtiana 3 1 Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.1 0.1 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3 Opercularia vaginata 0.2 <	Alexgeorgea nitens	0.1	0.1
Banksia menziesii 2.5 4 Bossiaea eriocarpa 0.4 5 Calytrix ?flavescens 0.4 0.1 Calytrix ?fraseri 1 0.3 Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius 0.4 4 Drosera parvula 0.1 0.1 Eremaea pauciflora 1.2 8 Eucalyptus todtiana 3 1 Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.4 0.1 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3 Opercularia vaginata 0.2 0.1 Patersonia occidentalis 0.4	Amphipogon sp.	0.2	0.1
Bossiaea eriocarpa Calytrix ?flavescens 0.4 0.1 Calytrix ?fraseri 1 0.3 Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius 0.4 Drosera parvula 0.1 Eremaea pauciflora Eucalyptus todtiana Gompholobium tomentosum 0.2 Hibbertia huegelii 0.4 Hypocalymma xanthopetalum 0.4 Dacksonia nutans 1 Eepidosperma pubisquameum 0.4 Leucopogon conostephioides 0.1 Macarthuria apetala 0.2 Melaleuca ?clavifolia 0.4 Dacksonia noccidentalis 0.4 Dacksonia occidentalis 0.	Banksia attenuata	3.5	10
Calytrix ?flavescens Calytrix ?fraseri Conostephium pendulum 0.6 0.1 Dasypogon obliquifolius Drosera parvula Drosera pauciflora Eremaea pauciflora Eucalyptus todtiana Gompholobium tomentosum 0.2 Hibbertia huegelii Hypocalymma xanthopetalum 0.4 Dacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides D.4 Macarthuria apetala D.2 D.1 Melaleuca ?clavifolia D.4 D.5 Petrophile linearis Podotheca ?chrysantha 0.4 0.1 0.3 Ona Ona Ona Ona Ona Ona Ona On	Banksia menziesii	2.5	4
Calytrix ?fraseri Conostephium pendulum O.6 O.1 Dasypogon obliquifolius Drosera parvula Drosera parvula Eucalyptus todtiana Gompholobium tomentosum O.2 Hibbertia huegelii Hypocalymma xanthopetalum O.4 Dacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides D.4 Macarthuria apetala O.2 Melaleuca ?clavifolia O.4 D.5 Petrophile linearis Podotheca ?chrysantha O.4 O.1 O.5 O.2 O.1 O.3 O.4 O.5 O.5 O.5 O.4 O.5 O.5 O.5	Bossiaea eriocarpa	0.4	5
Conostephium pendulum Dasypogon obliquifolius O.4 Drosera parvula O.1 D.1 Eremaea pauciflora Eucalyptus todtiana Gompholobium tomentosum O.2 Hibbertia huegelii O.4 Hypocalymma xanthopetalum O.4 Dacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides D.4 D.1 Leucopogon aff. sprengelioides O.4 Macarthuria apetala O.2 Melaleuca ?clavifolia O.4 D.5 Petrophile linearis O.4 O.5 Stirlingia latifolia O.1 O.1 O.1 O.1 O.1 O.1 O.1 O.1 O.2 O.1 O.1 O.1 O.1 O.2 O.1	Calytrix ?flavescens	0.4	0.1
Dasypogon obliquifolius0.44Drosera parvula0.10.1Eremaea pauciflora1.28Eucalyptus todtiana31Gompholobium tomentosum0.20.1Hibbertia huegelii0.40.2Hibbertia hypericoides0.48Hypocalymma xanthopetalum0.40.1Jacksonia nutans18Lepidosperma pubisquameum0.40.1Leucopogon conostephioides0.10.1Leucopogon aff. sprengelioides0.40.1Macarthuria apetala0.20.1Melaleuca ?clavifolia0.63Opercularia vaginata0.20.1Patersonia occidentalis0.45Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Calytrix ?fraseri	1	0.3
Drosera parvula Eremaea pauciflora 1.2 8 Eucalyptus todtiana Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum Leucopogon conostephioides 0.4 Macarthuria apetala 0.2 Melaleuca ?clavifolia 0.4 Detrophile linearis 0.4 Constitution and service serv	Conostephium pendulum	0.6	0.1
Eremaea pauciflora Eucalyptus todtiana Gompholobium tomentosum Hibbertia huegelii Hibbertia hypericoides Hypocalymma xanthopetalum Jacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides Leucopogon aff. sprengelioides Macarthuria apetala Opercularia vaginata Patersonia occidentalis Petrophile linearis Podotheca ?chrysantha 1.2 8 1.2 8 1.2 8 1.2 0.1 0.4 0.2 0.1 0.1 0.1 0.1 0.1 0.1 0.2 0.1 0.1	Dasypogon obliquifolius	0.4	4
Eucalyptus todtiana 3 1 Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.4 0.1 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3 Opercularia vaginata 0.2 0.1 Patersonia occidentalis 0.4 5 Petrophile linearis 0.4 0.3 Podotheca ?chrysantha 0.1 0.1 Stirlingia latifolia 0.4 0.5	Drosera parvula	0.1	0.1
Gompholobium tomentosum 0.2 0.1 Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 Hypocalymma xanthopetalum 0.4 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 Leucopogon conostephioides 0.1 Leucopogon aff. sprengelioides 0.4 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3 Opercularia vaginata 0.2 0.1 Patersonia occidentalis 0.4 5 Petrophile linearis 0.4 0.5 Stirlingia latifolia 0.5	Eremaea pauciflora	1.2	8
Hibbertia huegelii 0.4 0.2 Hibbertia hypericoides 0.4 8 Hypocalymma xanthopetalum 0.4 0.1 Jacksonia nutans 1 8 Lepidosperma pubisquameum 0.4 0.1 Leucopogon conostephioides 0.1 0.1 Leucopogon aff. sprengelioides 0.4 0.1 Macarthuria apetala 0.2 0.1 Melaleuca ?clavifolia 0.6 3 Opercularia vaginata 0.2 0.1 Patersonia occidentalis 0.4 5 Petrophile linearis 0.4 0.3 Podotheca ?chrysantha 0.1 0.1 Stirlingia latifolia 0.4 0.5	Eucalyptus todtiana	3	1
Hibbertia hypericoides Hypocalymma xanthopetalum Jacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides Leucopogon aff. sprengelioides Macarthuria apetala Opercularia vaginata Opercularia vaginata Patersonia occidentalis Petrophile linearis Podotheca ?chrysantha Stirlingia latifolia O.4 O.1 O.4 O.1 B 8 O.4 O.1 O.1 O.1 O.1 O.1 O.1 O.1	Gompholobium tomentosum	0.2	0.1
Hypocalymma xanthopetalum Jacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides Leucopogon aff. sprengelioides Macarthuria apetala Olepercularia vaginata Opercularia vaginata Patersonia occidentalis Petrophile linearis Podotheca ?chrysantha Stirlingia latifolia Ole Olepercularia vaginata	Hibbertia huegelii	0.4	0.2
Jacksonia nutans Lepidosperma pubisquameum Leucopogon conostephioides Leucopogon aff. sprengelioides Macarthuria apetala O.2 Melaleuca ?clavifolia Opercularia vaginata Opercularia occidentalis Petrophile linearis Podotheca ?chrysantha Stirlingia latifolia O.4 O.5 O.4 O.5 Stirlingia latifolia O.4 O.5 O.4 O.5	Hibbertia hypericoides	0.4	8
Lepidosperma pubisquameum0.40.1Leucopogon conostephioides0.10.1Leucopogon aff. sprengelioides0.40.1Macarthuria apetala0.20.1Melaleuca ?clavifolia0.63Opercularia vaginata0.20.1Patersonia occidentalis0.45Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Hypocalymma xanthopetalum	0.4	0.1
Leucopogon conostephioides Leucopogon aff. sprengelioides Macarthuria apetala O.2 Melaleuca ?clavifolia Opercularia vaginata Opercularia occidentalis Petrophile linearis O.4 Stirlingia latifolia O.1 O.1 O.1 O.1 O.1 O.1 O.1 O.	Jacksonia nutans	1	8
Leucopogon aff. sprengelioides Macarthuria apetala O.2 O.1 Melaleuca ?clavifolia Opercularia vaginata Opercularia occidentalis Petrophile linearis Podotheca ?chrysantha O.4 O.5 Stirlingia latifolia O.4 O.5	Lepidosperma pubisquameum	0.4	0.1
Macarthuria apetala0.20.1Melaleuca ?clavifolia0.63Opercularia vaginata0.20.1Patersonia occidentalis0.45Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Leucopogon conostephioides	0.1	0.1
Melaleuca ?clavifolia0.63Opercularia vaginata0.20.1Patersonia occidentalis0.45Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Leucopogon aff. sprengelioides	0.4	0.1
Opercularia vaginata0.20.1Patersonia occidentalis0.45Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Macarthuria apetala	0.2	0.1
Patersonia occidentalis Petrophile linearis O.4 O.3 Podotheca ?chrysantha Stirlingia latifolia O.4 O.5	Melaleuca ?clavifolia	0.6	3
Petrophile linearis0.40.3Podotheca ?chrysantha0.10.1Stirlingia latifolia0.40.5	Opercularia vaginata	0.2	0.1
Podotheca ?chrysantha 0.1 0.1 Stirlingia latifolia 0.4 0.5	Patersonia occidentalis	0.4	5
Stirlingia latifolia 0.4 0.5	Petrophile linearis	0.4	0.3
	Podotheca ?chrysantha	0.1	0.1
Stylidium crossocenhalum 0.1	Stirlingia latifolia	0.4	0.5
o.1 U.1	Stylidium crossocephalum	0.1	0.1
Trachymene pilosa 0.1 0.1	Trachymene pilosa	0.1	0.1



Xanthorrhoea preissii	1.6	2
Xanthosia huegelii	0.1	0.1





Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 345733E 6609578N

Community: W-E

Landform Type: Basin

Soil Type: Clay

Soil Colour: Grey

Fire: >5

Comments: Woodland

Taxon Name	Avg. Height	Cover Alive
<i>Acacia saligna</i> subsp. <i>lindleyi</i> ms	2	0.1
*Aira caryophyllea	0.1	0.1
Crassula ?colorata	0.1	0.1
Daucus glochidiatus	0.1	0.1
Eucalyptus rudis	11	25
Exocarpos sparteus		
*Hypochaeris glabra	0.1	0.1
Kunzea micrantha subsp. ?petiolata	1.6	0.2
*Lysimachia arvensis	0.1	0.1
Melaleuca rhaphiophylla	2	1
Trachymene pilosa	0.1	0.1
Viminaria juncea	2	0.1
*Vulpia ?myuros	0.2	0.1







Site Type: RELEVE

Survey Date: 03/11/2008

GPS Location: GDA94 Zone 50 345596E 6609533N

Community: W-E

Landform Type: Lowerslope

Soil Type: Silty clay

Soil Colour: Grey

Fire: >5

Comments: Tall scrub

Taxon Name	Avg. Height	Cover Alive
Acacia saligna subsp. lindleyi ms	2	5
*Aira caryophyllea	0.1	0.1
Banksia telmatiaea	0.6	0.1
*Briza maxima	0.1	0.1
Calothamnus hirsutus	0.3	0.1
Cassytha glabella		0.1
Eucalyptus rudis		
Exocarpos sparteus	2	0.1
Hakea trifurcata	0.8	0.1
Hakea varia	0.4	0.1
Kunzea micrantha subsp. ?petiolata	1	1
*Lysimachia arvensis	0.1	0.1
Melaleuca incana subsp. incana	1.5	20
Melaleuca rhaphiophylla	1.2	30
Melaleuca teretifolia	1	2
Melaleuca viminea subsp. viminea	1	3
Pogonolepis stricta	0.1	0.1
Samolus repens	0.5	0.1
*Ursinia anthemoides	0.1	0.1
Viminaria juncea	3	2
*Vulpia ?myuros	0.1	0.1







Site Type: RELEVE

Survey Date: 04/11/2008

GPS Location: GDA94 Zone 50 346379E 6608741N

Community: D-B

Landform Type: Midslope

Soil Type: Sand
Soil Colour: Yellow

Fire: >10

Comments: Woodland

Taxon Name	Avg. Height	Cover Alive
Acacia pulchella	1	0.5
Allocasuarina humilis	1.5	25
Anigozanthos humilis subsp. humilis	0.2	0.1
Banksia attenuata	3	0.5
Banksia dallanneyi	0.1	0.1
Banksia prionotes	4	25
Calytrix ?fraseri	0.8	0.1
Caustis dioica	0.3	0.1
Comesperma calymega	0.3	0.1
Conospermum stoechadis	1	1
Conostylis ?aculeata subsp. aculeata	0.2	0.1
Conostylis aculeata subsp. spinuligera	0.3	0.1
Dasypogon obliquifolius	0.3	1
Hakea costata	1	0.1
Hakea ruscifolia	1	0.1
Hakea trifurcata	2	1
Hemiphora bartlingii	0.6	0.1
Hibbertia crassifolia	0.6	0.1
Hibbertia huegelii	0.2	0.1
Hibbertia hypericoides	0.6	8
Hypocalymma xanthopetalum	0.3	0.1
Jacksonia hakeoides	0.6	0.1
Lechenaultia linarioides	0.2	0.1
Lepidobolus preissianus subsp. preissianus	0.3	0.1
Leucopogon aff. sprengelioides	0.6	0.1
Logania spermacocea	0.3	0.1
Melaleuca ?clavifolia	0.3	0.5
Melaleuca leuropoma	0.3	1
Mesomelaena pseudostygia	0.3	0.1
Neurachne alopecuroidea	0.1	0.1



Nuytsia floribunda	2	0.1
Patersonia occidentalis	0.3	1
Petrophile brevifolia	0.4	0.1
Petrophile macrostachya	0.4	0.1
Petrophile recurva	1	0.1
Pterochaeta paniculata	0.1	0.1
Schoenus pleiostemoneus	0.1	0.1
Stirlingia latifolia	0.3	0.1
Stylidium adpressum	0.1	0.1
Stylidium crossocephalum	0.1	0.1
Thysanotus dichotomus	0.3	0.1
Tricoryne elatior	0.4	0.1
Xanthorrhoea preissii	1	0.5





Site Type: RELEVE

Survey Date: 04/11/2008

GPS Location: GDA94 Zone 50 345574E 6608766N

Community: W-A

Landform Type: Lowerslope

Soil Type: Sand

Soil Colour: Brown

Fire: >5

Comments: Heath

Taxon Name	Avg. Height	Cover Alive
Acacia saligna subsp. lindleyi ms	0.4	0.1
Austrostipa compressa	0.6	0.1
Banksia telmatiaea	1	10
*Briza maxima	0.2	0.1
*Briza minor	0.2	0.1
Conostylis ?aculeata subsp. aculeata	0.3	0.1
Cyathochaeta avenacea	0.3	1
Darwinia pinifolia	0.1	0.1
Hakea varia	1	0.2
Isotoma hypocrateriformis	0.2	0.1
?Lomandra maritima	0.1	0.1
Melaleuca ?seriata	0.4	1
Melaleuca viminea subsp. viminea	0.3	15
Neurachne alopecuroidea	0.1	0.1
Patersonia occidentalis	0.3	0.5
Petrophile seminuda	0.4	0.1
Ptilotus manglesii	0.1	0.1
*Ursinia anthemoides	0.2	0.1
Verticordia densiflora	1	1
Verticordia pennigera	0.4	0.3
Waitzia suaveolens var. suaveolens	0.1	0.1
Xanthorrhoea preissii	1	1







Site Type: RELEVE

Survey Date: 05/11/2008

GPS Location: GDA94 Zone 50 339803E 6613340N

Community: W-D

Landform Type: basin

Soil Type: sandy loam and sandy clay

Soil Colour: brown and red

Fire: >10

Comments: Melaleuca Thicket

Taxon Name	Avg. Height	Cover Alive
Calandrinia sp. Kenwick (G.J. Keighery		
10905)		
Cassytha glabella		0.5
Crassula ?colorata	0.1	0.1
Eryngium pinnatifidum subsp. pinnatifidum	0.1	0.1
ms		
Frankenia pauciflora	0.2	3
Gahnia trifida	0.6	0.1
Hakea varia	0.5	0.1
*Hypochaeris glabra	0.1	0.1
*Lysimachia arvensis	0.1	0.1
Melaleuca acutifolia		
Melaleuca viminea subsp. viminea	3	30
Olearia axillaris	1	0.1
Schenkia ?australis	0.1	0.1
Tecticornia indica subsp. bidens		







Site Type: RELEVE

Survey Date: 05/11/2008

GPS Location: GDA94 Zone 50 341442E 6612684N

Community: W-C

Landform Type: lowerslope

Slope Class: flat

Soil Type: sand

Soil Colour: brown over pale yellow

Fire: >5

Comments: Heath

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa	0.6	15
Anarthria laevis	0.4	0.1
Bankia ?nivea subsp. nivea	0.3	0.1
Banksia menziesii	0.4	0.1
Banksia telmatiaea	0.7	30
Calytrix aurea		
Conostylis aculeata subsp. spinuligera	0.4	0.1
Hakea varia	0.6	0.1
Hypolaena pubescens	0.3	0.1
Isopogon panduratus subsp. palustris (P3)	0.3	0.1
Lepidosperma ?longitudinale	0.4	0.1
Melaleuca seriata	0.8	0.1
Nuytsia floribunda		
Olax scalariformis	0.4	0.1
Phlebocarya ciliata		
Pimelea imbricata var. ?piligera	0.4	0.1
Regelia ciliata	0.6	5
Scaevola ?lanceolata	0.3	0.1
Stirlingia latifolia	0.4	0.1
Verticordia ?blepharophylla		
Verticordia densiflora	0.4	0.1
Viminaria juncea	2	0.1







Site Type: RELEVE

Survey Date: 06/11/2008

GPS Location: GDA94 Zone 50 345980E 6607148N

Community: W-D

Landform Type: basin

Slope Class: flat

Soil Type: silty sand

Soil Colour: grey-brown

Fire: >8

Comments: Heath

Taxon Name	Avg. Height	Cover Alive
Anarthria laevis	0.4	0.1
Banksia nivea subsp. nivea	0.4	0.2
Burchardia multiflora	0.4	0.1
Chaetanthus aristatus	0.4	0.1
Gahnia trifida	1	4
Goodenia pulchella subsp. Coastal Plain A	0.3	0.2
(M. Hislop 634)		
Hypocalymma angustifolium	0.6	0.1
*Hypochaeris glabra	0.2	0.1
Kunzea micrantha subsp. ?petiolata	2	35
Melaleuca brevifolia	1	5
Melaleuca viminea subsp. viminea	2	20
Nuytsia floribunda	2	0.1
*Orobanche minor	0.3	0.1
Podolepis gracilis	0.2	0.1
Samolus repens	0.4	0.1
Schoenus subfascicularis	0.4	1
*Sonchus oleraceus	0.4	0.1
Viminaria juncea		-
*Wahlenbergia capensis	0.2	0.1
Xanthorrhoea preissii	1.5	0.5







Site Type: RELEVE

Survey Date: 06/11/2008

GPS Location: GDA94 Zone 50 346640E 6606999N

Community: D-A

Landform Type: midslope

Slope Class: flat

Soil Type: sand

Soil Colour: grey over brown

Fire: >7

Comments: Woodland over heath

Taxon Name	Avg. Height	Cover Alive
Acacia sphacelata subsp. verticillata	0.4	0.1
Adenanthos cygnorum	4	0.5
Alexgeorgea nitens	0.1	0.1
Amphipogon sp.	0.4	0.1
Anigozanthos humilis subsp. humilis	0.2	0.1
Banksia attenuata	3	15
Banksia menziesii	4	3
Blancoa canescens	0.2	0.1
Bossiaea eriocarpa	0.4	0.1
Cassytha flava		0.1
Chordifex sinuosus	0.4	0.1
Conospermum stoechadis	1	1
Conostephium pendulum	0.4	0.1
Conostylis aurea	0.3	0.1
Conostylis teretifolia subsp. teretifolia	0.1	0.1
Dampiera spicigera	0.1	0.1
Dasypogon obliquifolius	0.4	1
Daviesia divaricata	1	0.1
Eremaea pauciflora	1	20
Eucalyptus todtiana	6	1
Haemodorum spicatum	0.4	0.1
Hemiandra pungens		
Hibbertia crassifolia	0.4	0.1
Hibbertia huegelii	0.4	0.1
Hibbertia hypericoides	1	5
Hypocalymma xanthopetalum	0.4	0.1
Isotropis cuneifolia subsp. cuneifolia	0.2	0.1
Jacksonia floribunda	1	0.1
Jacksonia nutans	1	0.1



Lepidobolus preissianus subsp. preissianus	0.4	0.1
Lepidosperma aff. scabrum	0.6	0.1
Lyginia imberbis	0.4	0.1
Melaleuca ?clavifolia	0.3	0.1
Mesomelaena pseudostygia	0.3	6
Neurachne alopecuroidea	0.3	0.1
Patersonia occidentalis	0.3	0.1
Persoonia ?trinervis	0.3	0.1
Petrophile linearis	0.4	0.1
Phlebocarya filifolia	0.4	0.1
Pileanthus filifolius	0.3	3
Schoenus clandestinus	0.1	0.1
Schoenus pleiostemoneus	0.3	0.1
Scholtzia ?involucrata	1	1
Stylidium crossocephalum	0.2	0.1
Stylidium cygnorum	0.1	0.1
Stylidium repens	0.1	0.1
Synaphea spinulosa subsp. spinulosa	0.4	0.1





Site Type: RELEVE

Survey Date: 06/11/2008

GPS Location: GDA94 Zone 50 347867E 6606471N

Community: D-B

Landform Type: upperslope

Slope Class: gentle

Soil Type: sand

Soil Colour: brown over yellow

Fire: >8

Comments: Woodland

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum	3	1
Banksia attenuata	3	1
Banksia prionotes	6	35
Burchardia congesta	0.6	0.1
Cassytha flava		0.1
Caustis dioica	0.4	0.1
Conospermum stoechadis	1	1
Conostylis aurea	0.4	0.1
Conostylis teretifolia subsp. teretifolia	0.1	0.1
Dasypogon obliquifolius	0.4	0.1
Eremaea pauciflora	1	2
Gompholobium tomentosum	0.4	0.1
Haemodorum spicatum	1	0.1
Hakea costata	1	0.1
Hibbertia huegelii	0.4	0.1
Hibbertia hypericoides	1	4
Hypocalymma xanthopetalum	0.4	0.1
Lepidobolus preissianus subsp. preissianus	0.4	0.1
Lepidosperma aff. scabrum	0.4	0.1
Leptospermum erubescens	2	10
Leucopogon conostephioides	0.3	0.1
Lyginia imberbis	0.6	0.1
Melaleuca ?clavifolia	0.3	0.5
Mesomelaena pseudostygia	0.4	1
Mirbelia ?spinosa	0.4	0.1
Neurachne alopecuroidea	0.2	0.1
Opercularia vaginata	0.1	0.1
Patersonia occidentalis	0.4	0.1
Pileanthus filifolius	0.4	3



Pimelea sulphurea	0.4	0.1
Schoenus clandestinus	0.1	0.1
Tricoryne elatior	0.4	0.1





MAPPING NOTES

Site Name: OMN01

Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 344570.2E 6610490.88N

Comments: Banksia attenuata and Banksia menziesii to NW appears to be a transition zone.

NE of this reflects OLF14











Site Type: MAPPING_NOTE

Survey Date: 04/10/2022

GPS Location: GDA94 Zone 50 347364.59E 6606872.38N

Soil Type: Sandy Clay

Soil Colour: Grey

Comments: Within boundary of CLW VT 17

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Calothamnus hirsutus		
Hakea obliqua subsp. parviflora		
Hibbertia stellaris		
Melaleuca rhaphiophylla		
Melaleuca seriata		
Pericalymma ellipticum var. ellipticum		
Regelia ciliata		
Verticordia densiflora var. densiflora		









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 347259.7E 6606700.05N

Comments: Within boundary of CLW VT 17 but is not Banksia woodland. Wet heath over

mixed open sedgeland and annual herbs

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Calothamnus hirsutus		
Hakea obliqua subsp. parviflora		
Melaleuca rhaphiophylla		
Melaleuca viminea subsp. viminea		
Regelia ciliata		
Verticordia densiflora var. densiflora		









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 347240.75E 6606630.39N

Comments: Change from OMP03 to ROMP01 vegetation









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 347197.45E 6606601.94N

Comments: Change from ROMP01 to OMN03 vegetation









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 347174.41E 6606604.72N

Comments: Melaleuca preissiana on edges of OMN03 vegetation and Banksia woodland









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343465.3E 6610586.53N

Landform Type: Upper Slope

Soil Type: Sand

Soil Colour: Grey

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Comments: Mapped as CLW VT 5, interzone with VT 17. Different from veg in OMP08

(nearby)

Taxon Name	Avg. Height	Cover Alive
Acacia lasiocarpa var. lasiocarpa		
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia telmatiaea		
Bossiaea eriocarpa		
Eremaea asterocarpa subsp. asterocarpa		
Hakea obliqua subsp. parviflora		
Hakea varia		
Hibbertia hypericoides subsp. hypericoides		
Hypocalymma balbakiae		
Isopogon panduratus subsp. palustris (P3)		
Jacksonia hakeoides		
Petrophile linearis		
Trachymene pilosa		















Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343558.83E 6610537.11N

Landform Type: Lower Slope

Soil Type: Sandy Loam
Soil Colour: Grey

Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia platycarpa		
Banksia prionotes		
Banksia telmatiaea		
Beaufortia squarrosa		
Hakea obliqua subsp. parviflora		
Hibbertia subvaginata		
Isopogon panduratus subsp. palustris (P3)		
Jacksonia nutans		
Melaleuca preissiana		
Melaleuca rhaphiophylla		
Melaleuca seriata		
Nuytsia floribunda		
Regelia ciliata		
Verticordia lindleyi subsp. lindleyi (P4)		
Xanthorrhoea preissii		









Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343522.16E 6610520.62N

Comments: Near quadrat OMP08. Vegetation transitioning from Banksia woodland (with

Banksia menziesii) to OMN08 vegetation (Hakea obliqua subsp. parviflora,

Banksia telmatiaea and Adenanthos cygnorum subsp. cygnorum)











Site Type: MAPPING_NOTE

Survey Date: 06/10/2022

GPS Location: GDA94 Zone 50 343095.5E 6611305.76N

Comments: CLW VT 17

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Melaleuca seriata		





Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 342015.18E 6611804.39N

Community: W-C

Comments: Mapped as CLW VT 5, but more like quadrat OMP13 (mapped as CLW VT 1)











Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341877.12E 6611731.3N

Soil Type: Sandy Loam
Soil Colour: Grey-Brown

Comments: Open patch of vegetation mapped as CLW VT 5

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia platycarpa		
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Jacksonia hakeoides		
Melaleuca seriata		
Regelia ciliata		
Verticordia densiflora var. densiflora		
Verticordia lindleyi subsp. lindleyi (P4)		









Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341889.4E 6611750N

Comments: Vegetation in darker patch on aerial imagery is same as OMN12 with higher

density of Hakea obliqua subsp. parviflora and Banksia telmatiaea









Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341634.14E 6612110.44N

Comments: CLW VT 1

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Conostylis aculeata subsp. spinuligera		
Hakea varia		
Melaleuca seriata		
Regelia ciliata		









Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341526.74E 6612097.56N

Landform Type: Clay Pan

Disturbance: Exotic Weeds

Comments: Adjacent to quadrat OMP14. Clay pan. Vegetation similar to quadrat OMP14 but

more open. Weeds present

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
*Aira caryophyllea subsp. caryophyllea		
*Aira cupaniana		
Allocasuarina lehmanniana subsp.		
lehmanniana		
?Angianthus tomentosus		
Banksia telmatiaea		
Calandrinia granulifera		
Calandrinia sp. Kenwick (G.J. Keighery		
10905)		
Centrolepis polygyna		
Crassula closiana		
Crassula colorata var. acuminata		
Crassula exserta		
Hydrocotyle alata		
*Hypochaeris glabra		
*Lysimachia arvensis		
Melaleuca rhaphiophylla		
Melaleuca viminea subsp. viminea		
*Pentameris airoides subsp. airoides		
*Sagina apetala		
Senecio pinnatifolius var. latilobus		
*Sonchus oleraceus		









Site Type: MAPPING_NOTE

Survey Date: 07/10/2022

GPS Location: GDA94 Zone 50 341665.5E 6611992.06N

Comments: Vegetation same as OMP09

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Allocasuarina humilis		
Anigozanthos humilis subsp. humilis		
Austrostipa compressa		
Banksia attenuata		
Banksia menziesii		
Burchardia congesta		
Calytrix flavescens		
Conospermum stoechadis subsp. stoechadis		
Drosera ?drummondii		
Drosera erythrorhiza		
Drosera humilis		
Eremaea pauciflora var. pauciflora		
Eucalyptus todtiana		
Hibbertia hypericoides subsp. hypericoides		
Hibbertia striata		
Hypocalymma xanthopetalum		
Jacksonia floribunda		
Jacksonia nutans		
Melaleuca clavifolia		
Mesomelaena pseudostygia		
Petrophile linearis		
Pimelea sulphurea		
Schoenus clandestinus		
Stylidium araeophyllum		









Site Type: MAPPING_NOTE

Survey Date: 17/10/2022

GPS Location: GDA94 Zone 50 341707.62E 6613016.29N

Comments: On vegetation boundary; to SW is same as quadrat OLF15, to NE is heathland



Site Type: MAPPING_NOTE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339799.55E 6613842N

Comments: Patch of *Callitris pyramidalis* with surrounding heathland





Site Type: MAPPING_NOTE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339510.05E 6613304.43N

Soil Type: Sandy Loam

Soil Colour: Grey

Comments: CLW VT mapping appears correct

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Calothamnus quadrifidus subsp.		
angustifolius		
Hibbertia hypericoides subsp. hypericoides		
Jacksonia hakeoides		





Site Type: MAPPING_NOTE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341866.67E 6612352.1N

Soil Type: Sandy Loam

Soil Colour: Grey-Brown

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia attenuata		
Banksia menziesii		
Banksia telmatiaea		
Eucalyptus todtiana		
Jacksonia hakeoides		
Melaleuca seriata		



Site Type: MAPPING_NOTE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 341840.56E 6612419.68N

Comments: Very small patch of *Banksia telmatiaea* surrounded by Banksia woodland



Site Type: MAPPING_NOTE

Survey Date: 20/10/2022

GPS Location: GDA94 Zone 50 343020.55E 6612054.11N

Comments: Mid heathland of Banksia telmatiaea (common), Regelia ciliata (occasional),

Melaleuca rhaphiophylla (occasional) and Calothamnus quadrifidus subsp.

angustifolius (occasional)





Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 344332.3E 6610506.3N

Comments: Banksia woodland



Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 343278.46E 6610334.92N

Soil Type: Sandy Loam

Soil Colour: Grey

Comments: Low open Banksia woodland over tall open shrubland over low open shrubland

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia menziesii		
Eremaea pauciflora var. pauciflora		
Hibbertia hypericoides subsp. hypericoides		





Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 343468.72E 6610232.7N

Soil Type: Sandy Loam

Soil Colour: Grey

Comments: Low open Banksia woodland with occasional Nuytsia floribunda and Eucalyptus

todtiana over tall open shrubland over low open shrubland

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia menziesii		
Eucalyptus todtiana		
Nuytsia floribunda		





Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 343575.61E 6610265.85N

Soil Type: Sandy Loam

Soil Colour: Grey

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Hakea obliqua subsp. parviflora		
Regelia ciliata		





Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 343678.81E 6610276.33N

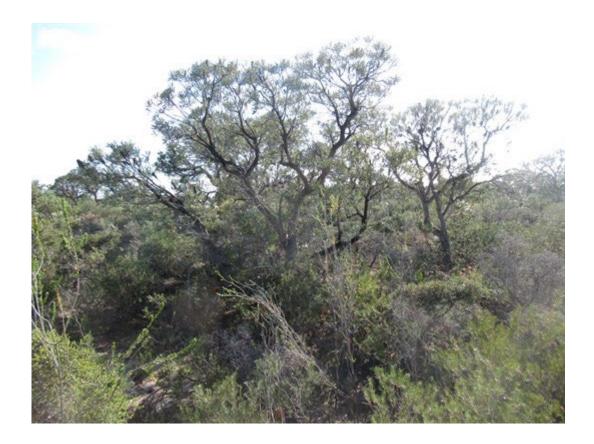
Soil Type: Sandy Loam
Soil Colour: Yellow-Brown

Comments: Low shrubland of *Banksia telmatiaea*. Appears to be transition zone between

Banksia woodland and heath, as woodland has *Banksia telmatiaea* in understorey (first photo). Low open woodland with *Banksia attenuata* and *Banksia menziesii* over mid open shrubland with mixed species (second photo)









Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 343838.07E 6610354.36N

Soil Type: Sandy Loam

Soil Colour: Grey

Comments: Low open Banksia woodland over low open shrubland of mixed species





Site Type: MAPPING_NOTE

Survey Date: 21/10/2022

GPS Location: GDA94 Zone 50 344164.42E 6610254.87N

Soil Type: Light Clay

Soil Colour: Grey

Comments: Mid wet shrubland. CLW VT mapping is incorrect; not a Banksia woodland

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia telmatiaea		
Melaleuca rhaphiophylla		
Melaleuca teretifolia		
Melaleuca viminea subsp. viminea		





Site Type: MAPPING_NOTE

Survey Date: 18/10/2022

GPS Location: GDA94 Zone 50 339778E 6613756N

Soil Type: Clayey Sand Soil Colour: Grey-White

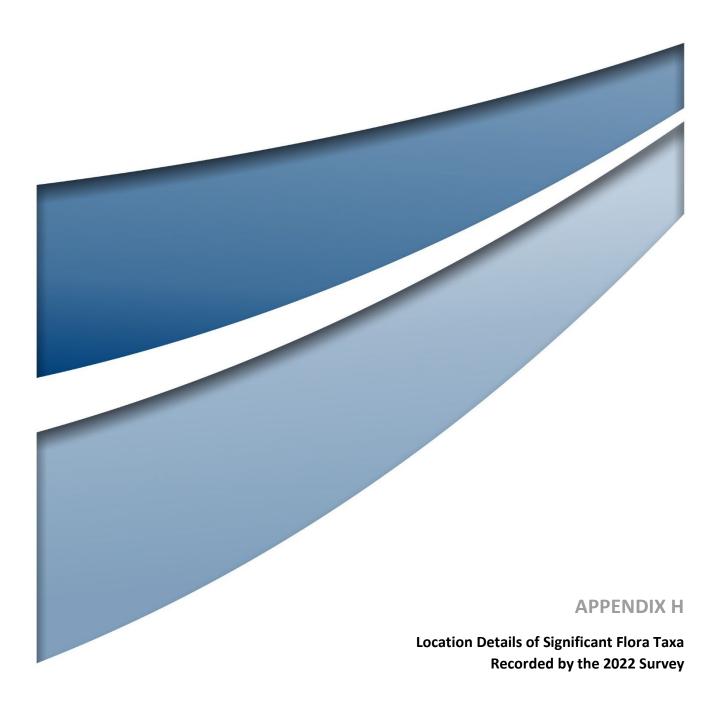
Vegetation Condition: Southern Vegetation Condition - 2 - Excellent

Comments: Mid sparse heath shrubland over low open heathland

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Banksia nivea subsp. nivea		
Banksia telmatiaea		
Hakea lissocarpha		
Hakea obliqua subsp. parviflora		
Melaleuca viminea subsp. viminea		
Regelia ciliata		





GOVERNMENT AGENCY REFERENCE ONLY

NOT FOR PUBLIC DISSEMINATION

CONTAINS LOCATIONS OF SIGNIFICANT FLORA TAXA



Note: all locations are in GDA2020 Zone 50.

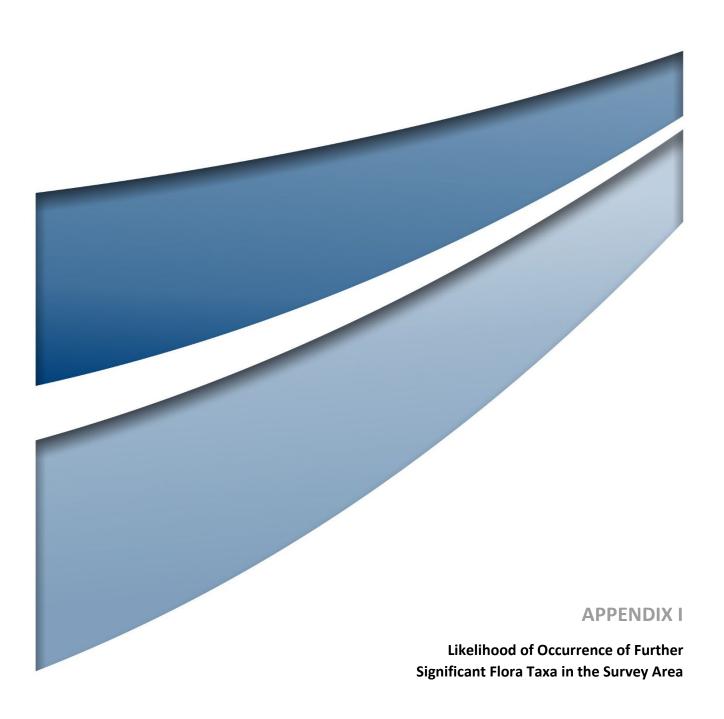
Table H.1 Location Details of Significant Flora Taxa Recorded by the 2022 Survey

Table H.1 Location Details of Significant Flora Taxa Recorded by the 2022 Survey							
Taxon	Status (WA)	Easting	Northing	VT	Site	Count*	
Anigozanthos viridis subsp. terraspectans	Т	347391	6606887	W-A		1	
Anigozanthos viridis subsp. terraspectans	Т	347386	6606898	W-A		1	
Anigozanthos viridis subsp. terraspectans	Т	347388	6606892	W-A		1	
Anigozanthos viridis subsp. terraspectans	Т	347261	6606702	W-C		1	
Anigozanthos viridis subsp. terraspectans	Т	347246	6606668	W-C		1	
Anigozanthos viridis subsp. terraspectans	Т	347234	6606623	W-A		1	
Babingtonia urbana	Р3	347204	6606561	W-A	ROMP01	NR	
Babingtonia urbana	Р3	339923	6613943	W-C	LFGS05	NR	
Babingtonia urbana	Р3	342323	6611493	W-C	OLF30	NR	
Babingtonia urbana	Р3	339946	6613459	W-C	LFGS04	NR	
Babingtonia urbana	P3	346909	6606899	W-A	ROMP02	NR	
Babingtonia urbana	Р3	341952	6611828	W-C	OMP13	NR	
Babingtonia urbana	P3	341199	6612503	W-C	LFGS10	NR	
Chordifex reseminans	P2	343506	6610585	W-C	OMP08	4	
Chordifex reseminans	P2	342940	6611223	W-C	OMP11	NR	
Chordifex reseminans	P2	341489	6612838	W-C	OLF21	NR	
Chordifex reseminans	P2	343626	6610480	W-C	OLF09	NR	
Chordifex reseminans	P2	343570	6611516	W-C	OLF13	NR	
Chordifex reseminans	P2	347613	6606582	W-C	OMP02	2	
Chordifex reseminans	P2	343217	6611324	W-C	OMP10	1	
Chordifex reseminans	P2	342323	6611493	W-C	OLF30	NR	
Conospermum scaposum	Р3	343626	6610480	W-C	OLF09	1	
Desmocladus nodatus	Р3	340387	6612788	W-C	OLF24	NR	
Desmocladus nodatus	Р3	343217	6611324	W-C	OMP10	NR	
Desmocladus nodatus	Р3	342940	6611223	W-C	OMP11	NR	
Grevillea cooljarloo	P1	342456	6611238	W-D	OMP12	NR	
Hypocalymma quadrangulare	Р3	346210	6608889	D-B	OLF01	NR	
Hypocalymma quadrangulare	Р3	340206	6613873	W-C	LFGS07	NR	
Hypocalymma quadrangulare	Р3	345185	6609204	D-A	OLF08	NR	
Hypocalymma quadrangulare	Р3	341684	6612981	D-A	OLF15	NR	
Hypocalymma quadrangulare	Р3	339596	6613417	W-C	OLF19	NR	
Hypocalymma quadrangulare	Р3	342698	6611701	W-C	OLF28	NR	
Hypocalymma quadrangulare	Р3	341895	6612641	D-A	OLF31	NR	
Hypocalymma quadrangulare	Р3	341199	6612503	W-C	LFGS10	NR	
Isopogon panduratus subsp. palustris	Р3	340464	6613699	W-C	LFGSR06	NR	
Isopogon panduratus subsp. palustris	Р3	343506	6610585	W-C	OMP08	15	
Isopogon panduratus subsp. palustris	Р3	343217	6611324	W-C	OMP10	2	



Taxon	Status (WA)	Easting	Northing	VT	Site	Count*
Isopogon panduratus subsp. palustris	Р3	341078	6613194	W-C	OLF34	NR
Isopogon panduratus subsp. palustris	Р3	341408	6613258	W-B	OLF37	NR
Isopogon panduratus subsp. palustris	Р3	339946	6613459	W-C	LFGS04	NR
Isopogon panduratus subsp. palustris	Р3	344259	6610124	W-C	OLF06	NR
Isopogon panduratus subsp. palustris	Р3	344571	6610492	W-C	OLF14	NR
Isopogon panduratus subsp. palustris	Р3	341199	6613164	W-C	OLF33	NR
Isopogon panduratus subsp. palustris	Р3	341413	6613204	W-C	OLF35	NR
Isopogon panduratus subsp. palustris	Р3	340206	6613873	W-C	LFGS07	NR
Isopogon panduratus subsp. palustris	Р3	340905	6612794	W-C	LFGS09	NR
Isopogon panduratus subsp. palustris	Р3	344605	6609823	W-C	OLF07	NR
Isopogon panduratus subsp. palustris	Р3	340387	6612788	W-C	OLF24	1
Isopogon panduratus subsp. palustris	Р3	339923	6613943	W-C	LFGS05	NR
Isopogon panduratus subsp. palustris	Р3	340173	6613760	W-C	LFGS06	NR
Isopogon panduratus subsp. palustris	Р3	340195	6613449	W-C	LFGSR05	NR
Isopogon panduratus subsp. palustris	Р3	340557	6613481	W-E	LFGS08	NR
Isopogon panduratus subsp. palustris	Р3	341411	6612568	W-C	LFGSR10	NR
Isopogon panduratus subsp. palustris	Р3	343466	6610588	W-C	OMN07	NR
Isopogon panduratus subsp. palustris	Р3	339961	6613481	W-C		28
Isopogon panduratus subsp. palustris	Р3	343560	6610539	W-C	OMN08	NR
Lepyrodia curvescens	P2	347613	6606582	W-C	OMP02	NR
Persoonia rudis	Р3	347613	6606582	W-C	OMP02	3
Poranthera asybosca	P1	340206	6613873	W-C	LFGS07	NR
Poranthera asybosca	P1	343973	6610654	D-B	OLF11	NR
Poranthera asybosca	P1	347064	6606822	D-A	OMP04	NR
Poranthera asybosca	P1	343072	6610629	D-B	OMP09	NR
Poranthera asybosca	P1	347452	6607185	D-A	OMP05	NR
Poranthera asybosca	P1	341895	6612641	D-A	OLF31	NR
Poranthera asybosca	P1	341961	6611664	W-C		20
Schoenus griffinianus	P4	347613	6606582	W-C	OMP02	7
Stylidium hymenocraspedum	Р3	341277	6613246	D-B		NR
Verticordia lindleyi subsp. lindleyi	P4	347613	6606582	W-C	OMP02	1
Verticordia lindleyi subsp. lindleyi	P4	343506	6610585	W-C	OMP08	NR
Verticordia lindleyi subsp. lindleyi	P4	344259	6610124	W-C	OLF06	NR
Verticordia lindleyi subsp. lindleyi	P4	341489	6612838	W-C	OLF21	6
Verticordia lindleyi subsp. lindleyi	P4	341199	6612503	W-C	LFGS10	NR
Verticordia lindleyi subsp. lindleyi	P4	343560	6610539	W-C	OMN08	NR
Verticordia lindleyi subsp. lindleyi	P4	341878	6611733	W-C	OMN12	NR

^{*} NR = Not recorded.





Note: taxa shaded in blue have known records within the Survey Area, and taxa shaded in grey were returned from the interrogation of the DCCEEW SPRAT Database but have not been previously recorded in the area according to DBCA databases (DBCA, 2021b, 2022a).

Symbols and sources are defined at the end of this appendix.

Taxon	Status	Status	Flowering	Habitat		Identifiable Nearest		Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Acacia benthamii	P2		August to October	Flats and plains, sand dunes, seasonal wetlands with grey or brown sand, often over limestone. Limestone breakaways	-	Y	10.6 km west	Unlikely Habitat not considered to be present. Nearest known location represents westerly extent of range
Allocasuarina grevilleoides	Р3		September to November	Slopes, outcrops and plains with rocky or gravelly brown sand or clay loam over laterite or granite	CLW: 7.	Y	ı	Unlikely Habitat not considered to be present
Andersonia gracilis	Т	EN	August to November	Winter-wet areas, near swamps with white-grey sand, sandy clay and gravelly loam	2022: D-A, W-B, W-C. CLW: 1, 2, 5, 6, 7, 9b, 17, 18.	Y	-	Known to occur
Angianthus micropodioides	P3		September to January	Winter-wet areas, shallow depressions, clay pans, subsaline flats and dunes adjacent to salt lakes with grey or brown clay loam or sand	CLW: 2, 5, 13.	Y	4.4 km to north	Unlikely Habitat not considered to be present
Anigozanthos humilis subsp. Badgingarra (S.D. Hopper 7114)	P2		September to December	Slopes, plains, flats and winter-wet areas with white or grey sand. Banksia woodland, low wet heath	-	Y	13.0 km east	Unlikely Western extent of known distribution is east of Survey Area (represented by nearest known location), closer to lateritic influence from Darling Scarp



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Anigozanthos humilis subsp. chrysanthus	P4		August to November	Slopes, plains and winter- wet areas with white, grey or yellow sand. Banksia woodland, low wet heath	CLW: 17, 18.	Y	2.2 km south	Possible Habitat possibly present, Survey Area occurs within known distribution
Arnocrinum gracillimum	P3		October to January	Lower slopes and plains with white or grey sand over laterite, sometimes gravelly	CLW: 17, 18.	Y	5.4 km east	Possible Habitat possibly present, Survey Area occurs slightly west of western extent of known distribution
Babingtonia aff. cherticola	PU		November to December	Sandplains, slopes and flats with brown or grey sand, sometimes gravelly and over laterite. Low wet heath	CLW: 1.	Y	27 km east	Unlikely Habitat possibly present, but western extent of known distribution is east of Survey Area (represented by nearest known location), closer to lateritic influence from Darling Scarp
Babingtonia delicata	P1		November	Winter-wet closed depressions, wetlands and lakes with white, yellow or grey clayey sand	-	Y	7.2 km southeast	Possible Habitat possibly present, Survey Area occurs slightly northwest of northern extent of known distribution
Banksia catoglypta	Т	VU	June	Slopes and breakaways with grey or white gravelly sand over laterite	-	Y	44.3 km north	Unlikely Taxon restricted to a small area between Eneabba and Badgingarra. Nearest known location represents most southerly extent of range
Banksia dallanneyi subsp. pollosta	Р3		August to September	Flats and slopes with grey or yellow sand with laterite or limestone	2022: W-C. CLW: 1, 5, 17, 18.	Y	-	Known to occur



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Beaufortia bicolor	P3		November to December	Upland areas with sandy soils over laterite	CLW: 7, 17, 18.	Y	0.8 km to west	Unlikely Habitat not considered to be present
Beaufortia eriocephala	P3		June, September to December	Ridges, low rises and flats with brown, grey or white sand or sandy clay and lateritic gravel over laterite or sometimes granite	CLW: 7.	Y	5.6 km to south	Unlikely Habitat not considered to be present
Beyeria cinerea subsp. cinerea	Р3		May to October	Slopes and hilltops with brown or grey calcareous sand over limestone	CLW: 8.	Y	10.0 km southwest	Unlikely Habitat not considered to be present. Nearest known location represents easterly extent of range
Beyeria gardneri	P3		August to September	Sandplains and hillsides with yellow sand, often over laterite	-	Y	4.5 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Byblis gigantea	P3		October to January	Low plains, flats and swamps with brown or white sand or sandy clay, sometimes peaty	-	Υ	4.4 km north	Unlikely Taxon distribution extends from Guildford (approx. 145 km south of Survey Area) to Boddington. Nearest known location likely to be a misidentification, as the closely related <i>Byblis lamellata</i> is common in the Cooljarloo area
Caladenia denticulata subsp. albicans	P1		August to September	Near-coastal calcareous sandy soils under tall Acacia species	CLW: 17, 18.	Y	4.8 km west	Unlikely Habitat not considered to be present. Nearest known location represents easterly extent of range



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Calectasia palustris	P2		September to November	Winter-wet flats and swamps with white sand	CLW: 1, 2, 5, 7.	Y	4.5 km to north	Possible Habitat possibly present, Survey Area occurs slightly south of known distribution
Calytrix aff. eneabbensis	PU		-	-	-	Y	-	Unlikely Taxonomic status of this entity unclear; WA Herbarium has been contacted for guidance. No individuals that resemble the entity referred to as <i>Calytrix</i> aff. eneabbensis were recorded by the 2022 survey, nor other previous surveys undertaken in the Osprey area for Tronox
Chamelaucium Iullfitzii	Т	EN	September to December	Hilltops, slopes and undulating plains with gravelly sand	-	Y	101 km southeast	Unlikely Taxon restricted to a very small area between Gingin, Bindoon and Muchea. Nearest known location represents most northerly extent of range
Comesperma rhadinocarpum	P2		October to November	Undulating plains, valley slopes and flats with grey, brown or yellow sandy loam or sand	CLW: 5.	Y	13 km to northeast	Possible Habitat possibly present, Survey Area occurs on edge of known distribution
Conostephium magnum	P4		July to September	Sand dunes and slopes with white-grey sand	2022: D-A. CLW: 1, 5, 6, 7, 8, 9b, 17, 18.	Y	-	Known to occur



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Desmocladus biformis	P3		September to October	Hills, slopes and undulating plains with white or brown sand or sandy clay over laterite	CLW: 17.	Y	10.7 km to east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp
Desmocladus elongatus	P4		August to December	Slopes, plains and uplands with white or grey sand over laterite	-	Y	9.5 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents southwesterly extent of range
Drakaea elastica	T	EN	October to November	Low plains and flats with grey or white sand	-	Y	27 km southeast	Unlikely Taxon distribution extends from south of Perth (approx. 175 km south of Survey Area) to Busselton, with the exception of a disjunct record near Guraga Lake
Drosera leioblastus	P1		September to October	White siliceous sand with laterite	-	Y	2.7 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Drosera leucostigma	P1		November	Sandy margins of winter- wet areas	-	Y	9.4 km east	Unlikely Taxon restricted to a very small area on the base of the Dandaragan Scarp, near Badgingarra and Watheroo. Nearest known location represents most southwesterly extent of range



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Drosera prophylla	P3		June to July	Hilltops, lateritic breakaways, ridges and slopes with gravelly sand over laterite	-	Y	6.4 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents southwesterly extent of range
Eremophila glabra subsp. chlorella	Т	EN	July to November	Winter-wet depressions, lake edges and flats with grey-white sandy clay or sand	CLW: 2.	Y	0.7 km to south	Possible Habitat possibly present, Survey Area occurs within known distribution
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3		September to November	Winter-wet flats and depressions and clay pans, sometimes inundated, with grey or brown clay or sandy clay	2022: W-A. CLW: 2, 16.	Y	-	Known to occur
Eucalyptus abdita	P2		February	Slopes and breakaways with laterite, sandy clay with gravel over laterite	-	Y	8.1 km east	Unlikely Habitat not considered to be present
Eucalyptus × balanites	Т	EN	February, June to July	Slopes and plains with white, brown or grey sand or sandy loam, sometimes gravelly and over laterite	-	Y	21 km north	Unlikely Taxon restricted to a very small area west of Badgingarra (with the exception of a disjunct record near Armadale). Nearest known location represents most southerly extent of range
Eucalyptus dolorosa	T	EN	February	Lateritic slopes and breakaways with gravelly/rocky brown loam	-	Y	20 km east	Unlikely Habitat not considered to be present. Taxon restricted to a single location on Mount Misery



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Eucalyptus leprophloia	Т	EN	July, November	Laterite breakaways with grey or white sand or sandy clay	-	Y	40 km north	Unlikely Habitat not considered to be present. Nearest known location represents most southerly extent of range
Eucalyptus macrocarpa subsp. elachantha	P4		August to December	Hillslopes, ridges, sandplains with white or grey sand over laterite	-	Y	6.8 km to east (excl. records in rehab)	Unlikely Habitat not considered to be present, typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Eucalyptus pendens	P4		August to October	Breakaways and slopes with white, yellow or brown gravelly sand or sandy loam over laterite	-	Y	8.1 km east	Unlikely Habitat not considered to be present. Nearest known location represents most southerly extent of range
Frankenia glomerata	P4		November	Salt lake edges, watercourses and flats with white sand or grey-brown sandy loam	2022: W-D. CLW: 1, 2, 13.	Υ	-	Known to occur However, as per Section 5.1.4, DBCA databases indicate that there are no records of this taxon in the Cooljarloo area (WA Herbarium, 1998-); it is possible this record may represent a misidentification
Grevillea batrachioides	T	EN	October to November	Slopes, plains and sandstone outcrops with brown gravelly sandy loam over sandstone	-	Y	49 km north	Unlikely Habitat not considered to be present. Taxon restricted to a very small area in Lesueur National Park



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Grevillea calliantha	Т	EN	April, August to October	Plains and lower slopes with sandy loam over laterite or occasionally ironstone	-	Y	12 km southeast	Unlikely Taxon restricted to a small area between Cataby and Dandaragan. Nearest known location represents most northwesterly extent of range
Grevillea saccata	P4		April or June to November	Hilltops and slopes with yellow or brown sand, usually with gravel and over laterite	-	Y	3.4 km to east	Unlikely Habitat not considered to be present, typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Guichenotia alba	Р3		July to August	Flats and lower slopes with white or grey sand or clay with gravel over laterite	CLW: 1, 5, 7, 18.	Y	3.4 km to east	Possible Habitat possibly present, Survey Area occurs within known distribution
Hakea longiflora	P3		June to July	High in landscape; hills, breakaways and plains with white, grey or yellow gravelly sand or sandy loam over laterite or occasionally sandstone	CLW: 1, 18.	Y	16.5 km to southeast	Unlikely Habitat not considered to be present, typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Hakea megalosperma	Т	VU	April to June	High in landscape; hills, breakaways, slopes and flats with white, grey or brown sand or sandy loam over laterite	-	Y	11.5 km east	Unlikely Habitat not considered to be present



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Haloragis foliosa	P3		December	Dunes, interdunal swales and open depressions with white, brown or grey sand or clay loam over limestone	-	Y	22 km northwest	Unlikely Habitat not considered to be present; typically restricted to coastal and near-coastal areas. Nearest known location represents most southerly extent of range
Hemiandra gardneri	Т	EN	August to November	Plains with yellow or grey sand or clayey sand		Y	57 km east	Unlikely Known distribution generally much further east of Survey Area on the Dandaragan Scarp. Nearest known location represents most westerly extent of range (with the exception of a disjunct record west of Lesueur National Park)
Hensmania stoniella	P3		September to November	Sandplains, flats and slopes with white, grey or lateritic sand	2022: D-A, D-B. CLW: 6, 17, 18.	Y	-	Known to occur
Hibbertia leptotheca	P3		August to September	Slopes, dunes and limestone ridges and outcrops with white, grey or brown calcareous sand over limestone	-	Y	12.4 km southwest	Unlikely Habitat not considered to be present; typically restricted to coastal and near-coastal areas. Nearest known location represents northern extent of range



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Hopkinsia anoectocolea	P3		September to December	Winter-wet depressions, floodplains, salt lakes with white or grey sand, often saline	-	Y	0.2 km east (in rehab)	Unlikely Taxon not known to be endemic to Cooljarloo area. Has been recorded in Cooljarloo rehabilitation, but of origin unknown; possibly introduced through seeding, or from topsoil. Taxon has not been recorded in remnant vegetation in Cooljarloo area despite numerous surveys
Hypocalymma gardneri	P3		August to September	Sandplains, upper slopes and heathland with grey- brown sand and laterite	CLW: 17.	Y	31 km to northeast	Unlikely Habitat not considered to be present; Survey Area occurs outside known distribution
Hypocalymma ×proliferum	P1		August	Lateritic slopes and plains with yellow, grey or brown sand. Margins of watercourses	-	Y	16.9 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents westerly extent of range
Hypocalymma serrulatum	P2		April to July, November, January	Drainage lines, edges of and slopes above winter-wet depressions with grey sand	CLW: 7.	Y	36 km to east	Unlikely Habitat not considered to be present; typically occurs on areas with greater laterite influence, generally closer to Dandaragan Scarp. Survey Area occurs west of known distribution



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Hypocalymma tetrapterum	P3		July to September	Slopes above and edges of drainage lines with brown or grey sandy loam and lateritic gravel. Often in open eucalypt woodlands	-	Y	3.5 km east	Unlikely Habitat not considered to be present; typically occurs on areas with greater laterite influence, generally closer to Dandaragan Scarp. Survey Area occurs west of known distribution
Hypolaena robusta	P4		September to November	Lateritic hills, plains and flats with white or grey sand and lateritic gravel over laterite, Banksia or Eucalyptus todtiana woodland	-	Y	5.4 km east	Unlikely Habitat not considered to be present, Survey Area occurs slightly west of known distribution
Isopogon autumnalis	Р3		April to June	Slopes, sandplains and flats with white, yellow or grey sand. Banksia woodland, upland areas	-	Y	5.8 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp
Isotropis cuneifolia subsp. glabra	Р3		August to October	Low rises and winter-wet depressions and flats with grey or brown sand or clay	CLW: 1, 5, 9b.	Y	4.9 km to south	Possible Habitat possibly present, Survey Area occurs just north of known distribution
Jacksonia anthoclada	P3		November	Slopes with brown, yellow or white sand over laterite, upland areas	-	Y	9.8 km northeast	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Nearest known location represents most southerly extent of range
Jacksonia carduacea	Р3		July, November to December	Plains and flats with white, grey or yellow sand, sometimes over laterite	2022: W-C. CLW: 1, 2, 5, 17, 18.	Y	-	Known to occur



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Lepidobolus densus	P4		August	Sandplains, lake edges and slopes with brown or yellow sand	CLW: 18.	Y	67 km to southeast	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. Not known from the Cooljarloo area
Lepidobolus quadratus	Р3		August to September	Dry kwongan, hillslopes and rises with grey-white sand and lateritic gravel, upland areas	-	Y	10.4 km east	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp
Leucopogon sp. Yanchep (M. Hislop 1986)	P3		April to June	Crests of low rises and plains, often coastal, with yellow, brown or grey sand over limestone. Banksia woodland	CLW: 1.	Y	33 km to south	Unlikely Habitat not considered to be present. Not known from the Cooljarloo area
Levenhookia preissii	P1		October to January	Winter-wet flats and wetlands with grey or brown sand	CLW: 17.	Y	0.4 km to west	Possible Habitat possibly present, Survey Area occurs within known distribution
Loxocarya gigas	P2		October to February	Lateritic breakaways, ridges, slopes and flats with white or grey sand over laterite	-	Y	50 km north	Unlikely Habitat not considered to be present. Majority of taxon records are from Warradarge east to Pinjarrega (west of Coorow), with the exception of a disjunct record in Boonanarring Nature Reserve



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Lyginia excelsa	P1		September to October	Slopes, undulating plains and open depressions with white or grey sandy loam	CLW: 1.	Y	-	Unlikely Habitat not considered to be present; typically occurs on upland areas on the Dandaragan Scarp. All records in Survey Area in Tronox-lluka database are historical misidentifications of Lyginia imberbis
Macarthuria keigheryi	Т	EN	September to October	Dunes, plains and low rises above winter-wet areas with white, brown or grey sand or clay loam. Banksia woodland, recently burnt areas	2022: D-A, D-B, W-C. CLW: 1, 5, 17, 18.	Y	-	Known to occur
Meionectes tenuifolia	P3		October to December	Inundated alluvial, granitic and winter-wet flats and wetlands with grey or brown sandy loam	-	Y	4.7 km west	Unlikely Coordinates of nearest known location (from DBCA database interrogation) are erroneous, and have been updated on Florabase to 43 km east of the Survey Area near Moora. All other records of this taxon occur east and south of Gingin



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Myriophyllum muelleri	P1		November	Inundated winter-wet depressions, freshwater lagoons	-	N	7.9 km northwest	Unlikely Habitat not considered to be present. According to specimens lodged at the WA Herbarium, only known from two locations; near Nambung National Park, and near Esperance. Coordinates of nearest known location are erroneous and do not match locality description (Nambung River), with actual record likely to be further north and/or west
Paracaleana dixonii	Т	EN	October to January	Undulating plains, flats and slopes with gravelly grey sand	CLW: 17, 18.	Y	1.4 km to south	Possible Habitat possibly present, Survey Area occurs just west of known distribution
Persoonia filiformis	P3		November to December	Sandplains with yellow or white sand over laterite	-	Y	4.8 km east	Unlikely Western extent of known distribution is east of Survey Area (represented by nearest known location), closer to lateritic influence from Darling Scarp
Phlebocarya pilosissima subsp. pilosissima	P3		August to October	Upland areas with white or grey sand with lateritic gravel	-	Y	5.7 km to northeast	Unlikely Habitat not considered to be present; typically occurs on upland, lateritic areas on the Dandaragan Scarp
Platysace ramosissima	P3		October to November	Undulating plains and flats with yellow, brown or grey sand	CLW: 1, 2, 5, 6, 7, 17, 18.	Y	35 km to southeast	Possible Habitat possibly present, Survey Area occurs within known distribution



Taxon	Status	Status	_	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Poranthera moorokatta	P2		September to November	White or grey sand	2022: D-A. CLW: 1, 17.	Y	1.3 km to north	Possible Habitat possibly present, Survey Area occurs within known distribution
Ptychosema pusillum	Т	VU	September to October	Low plains, slopes and dunes with white or grey sand. Banksia woodland	-	Y	15.7 km south- southeast	Unlikely Survey Area occurs outside accepted distribution. The location description for the record from near Badgingarra (no date attached) is potentially dubious, as this record is not mentioned in the Approved Conservation Advice for the species (DEWHA, 2008)
Schoenus badius	P2		September to October	Slopes, drainage lines and winter-wet flats with grey or brown sand	-	Y	3.4 km northwest	Unlikely Taxon not known from Cooljarloo area. DBCA location is erroneous; WAHerb specimen may be missing. Taxon restricted to near Dongara to Geraldton. Other specimens from Cooljarloo area previously identified as this taxon have been re-identified as Schoenus pennisetis (P3)
Schoenus natans	P4		September to December	Inundated winter-wet wetlands, clay pans and drainage lines with brown or grey clay, sometimes with lateritic gravel	CLW: 9a.	Y	7.0 km to south	Unlikely Habitat not considered to be present
Schoenus pennisetis	Р3		October to December	Winter-wet flats, wetlands and valley floors with grey, yellow or brown sandy loam	2022: W-C. CLW: 1, 2, 5, 6, 7, 10, 17.	Y	-	Known to occur



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Stenanthemum sublineare	P2		October to December	Slopes and flats with grey or brown sandy loam	CLW: 17.	Y	5.8 km to west	Possible Habitat possibly present, Survey Area occurs within known distribution
Stylidium aceratum	P3		October to November	Winter-wet flats, swamps and wetlands with grey or brown sandy loam	CLW: 2.	Y	0.9 km to west	Possible Habitat possibly present, Survey Area occurs within known distribution
Stylidium aeonioides	P4		September to November	Breakaways, slopes and flats with grey gravelly sand or clayey sand over laterite	-	Y	6.4 km to east	Unlikely Habitat not considered to be present
Stylidium carnosum subsp. ?Narrow leaves (J.A. Wege 490)	P1		September to October	Lateritic hillslopes and plains with white-grey sand	CLW: 18.	Y	-	Unlikely Habitat not considered to be present
Stylidium Iongitubum	P4		July, October to December	Winter-wet damplands, flats and wetlands with brown or grey clay loam	2022: W-D. CLW: 1, 9a, 13.	Y	-	Known to occur
Stylidium maritimum	P3		September to November	Dune slopes and flats, coastal heath and shrubland, open Banksia woodland with sand over limestone	-	Y	23 km west	Unlikely Habitat not considered to be present; restricted to coastal and near-coastal areas
Stylidium tinkeri	P1		April, October to November	Winter-wet depressions, flats, wetlands and valleys with brown or grey clay loam	-	Y	7.5 km northeast	Unlikely All but one known record occur across a small range between Arrowsmith and Three Springs, 109 km north of Survey Area. Nearest known location is disjunct from the remainder of records



Taxon	Status	Status	Flowering	Habitat		Identifiable	Nearest	Likelihood of Occurrence
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Stylidium torticarpum	P3		September to November	Adjacent to drainage lines, depressions, and beneath breakaways, heath or mallee shrubland on sandy clay or clay loam over laterite	-	Y	6.8 km north	Unlikely Taxon not known from Cooljarloo area. Nearest known location is erroneous; coordinates do not match locality description (Mount Lesueur area)
Styphelia obtecta	Т	EN	October to November	Plains with white, grey or yellow sand	-	Y	63 km north	Unlikely Taxon distribution extends from north of Eneabba to South Eneabba Nature Reserve (with the exception of a disjunct record at Alexander Morrison National Park)
Tetratheca angulata	P3		September to December	Slopes and hilltops with white, grey or brown gravelly sand or loam over laterite, bases of ridges and breakaways	-	Y	8.8 km east	Unlikely Habitat not considered to be present. Nearest known location represents most westerly extent of range
Thelymitra apiculata	P4		June to August	Slopes with grey or brown sand with lateritic gravel	CLW: 1.	N	0.5 km to south	Possible Habitat possibly present, Survey Area occurs within known distribution
Thelymitra pulcherrima	P2		July to September	Flats and slopes of lateritic hills with white-grey sand or grey-brown sandy clay	CLW: 1, 17.	N	3.3 km to south	Possible Habitat possibly present, Survey Area occurs within known distribution



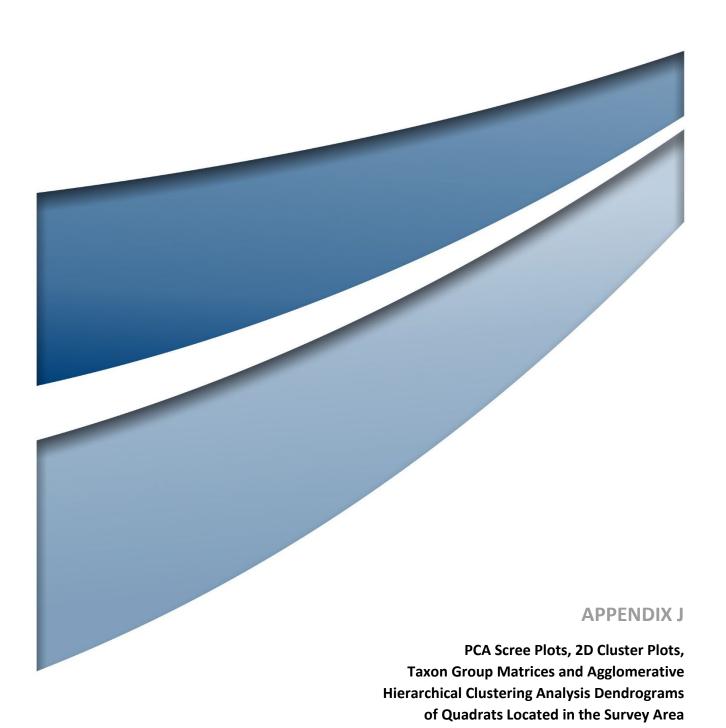
Taxon	Status	Status	Flowering	Habitat	Identifiable Nearest		Likelihood of Occurrence	
	(WA)	(EPBC)	Period ^{\$}	WA Herbarium ^{\$}	VTs*	During Survey	Location^	
Thelymitra stellata	Т	EN	October to November	Ridges and tops of lateritic hills with grey or brown sand or loam and lateritic gravel	-	Y	6.9 km east	Unlikely Habitat not considered to be present. Taxon not known from Cooljarloo area; taxon has disjunct distribution, with majority of records occurring from Coomallo Nature Reserve north to Arrowsmith, and a small number of records occurring from Boonanarring south to Armadale
Thysanotus glaucus	P4		October to January	Plains and slopes with white, grey or yellow sand or sandy gravel	2022: D-A, W-C. CLW: 17, 18.	Y	1	Known to occur
Verticordia amphigia	Р3		October to November	Winter-wet depressions with sandy loam, clay and rocky loam, ferricrete	-	Y	3.2 km east	Unlikely Habitat not considered to be present
Verticordia huegelii var. tridens	P3		September to November	Slopes and gullies with brown or cream clay loam, over laterite or sometimes granite or spongolite	-	Y	5.6 km south	Unlikely Taxon not known from Cooljarloo area. Previous record in area confirmed by Mattiske (2017) as a misidentification; correct identification is Verticordia huegelii var. decumbens

EN = Endangered; VU = Vulnerable; PU =Potentially undescribed.

⁵ Source: Specimen information from specimens lodged at the WA Herbarium (accessed via Florabase) (WA Herbarium, 1998-).

^{*} Survey Area and Cooljarloo West VTs within which known records occur (where spatial data is available).

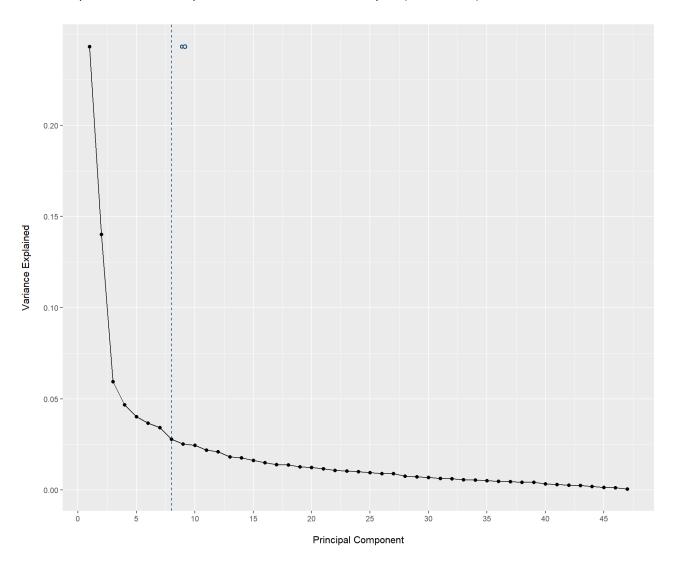
[^] Nearest known location to Survey Area, determined using data from interrogation of DBCA WA Herbarium Specimen and TPFL Databases (DBCA, 2021b) (for taxa that do not have known records in the Survey Area).





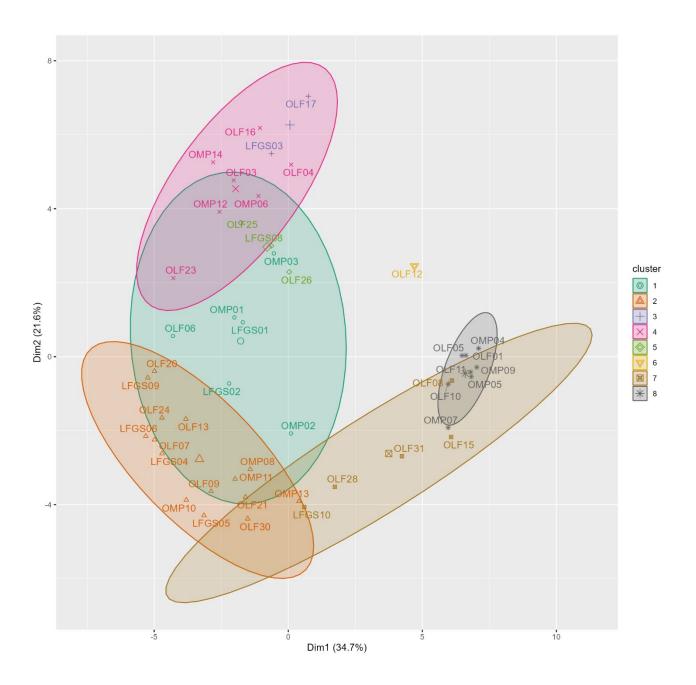
Analysis one: 2022 quadrat data only

PCA scree plot and result of optimal number of clusters analyses (dashed line)



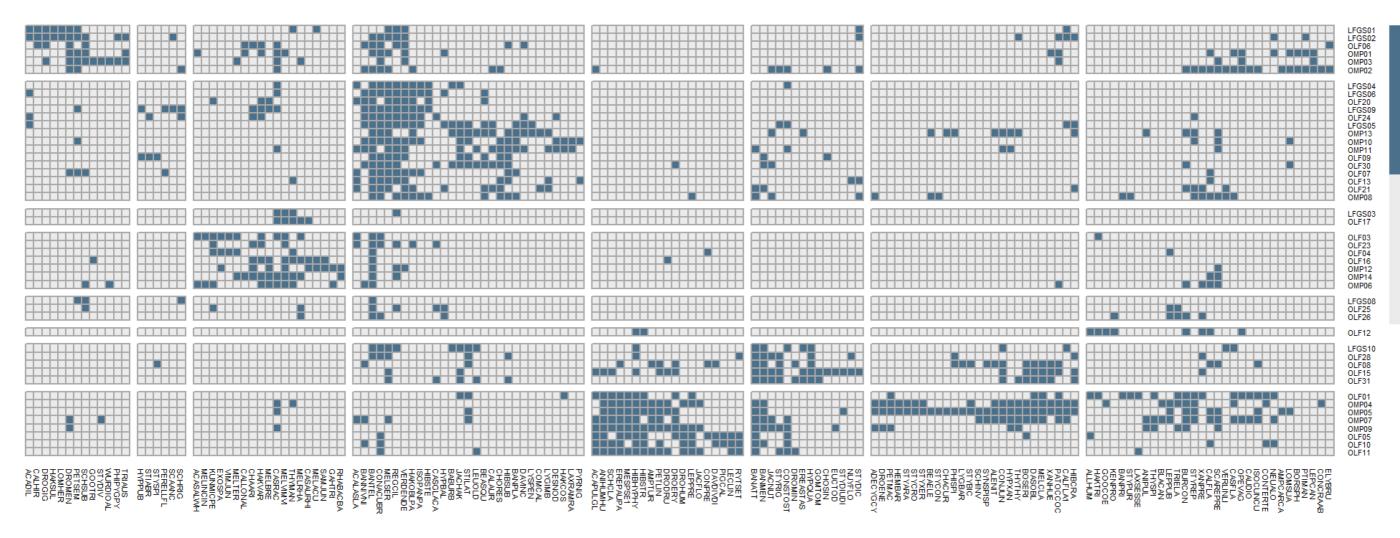


2D cluster plot





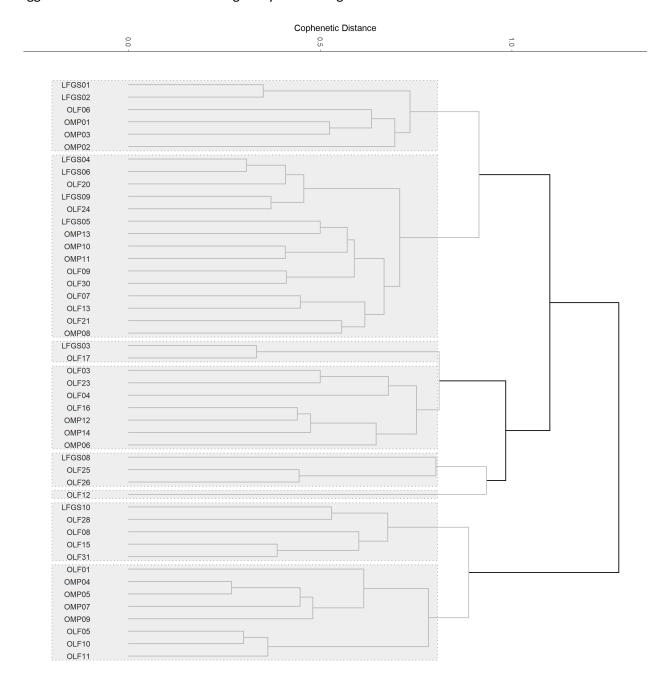
Taxon group matrix



Presen



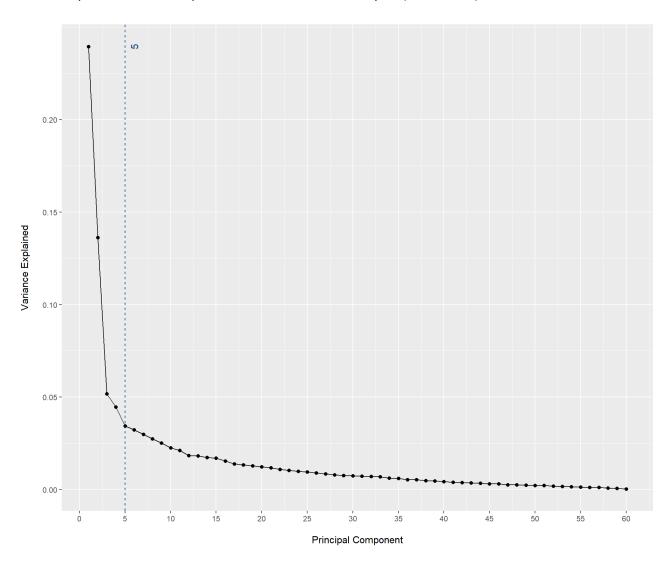
Agglomerative hierarchical clustering analysis dendrogram





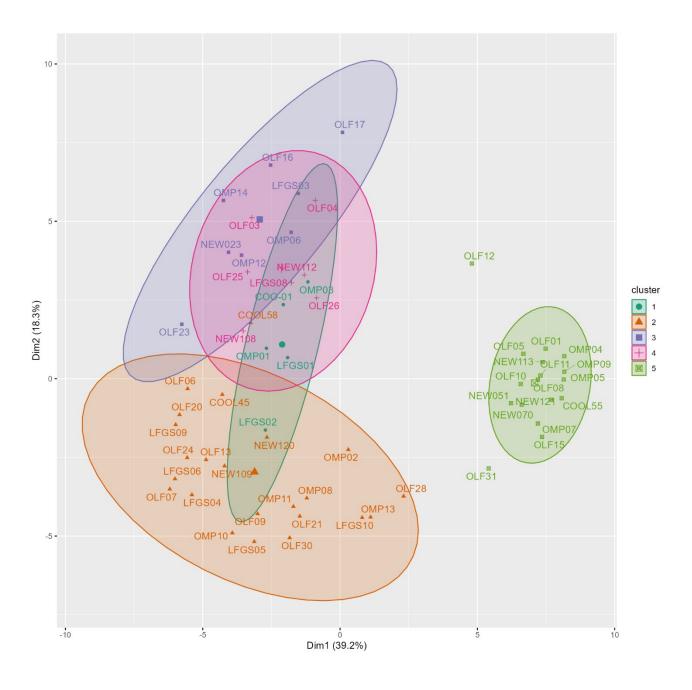
Analysis two: combined 2022 and historical Survey Area quadrat data

PCA scree plot and result of optimal number of clusters analyses (dashed line)



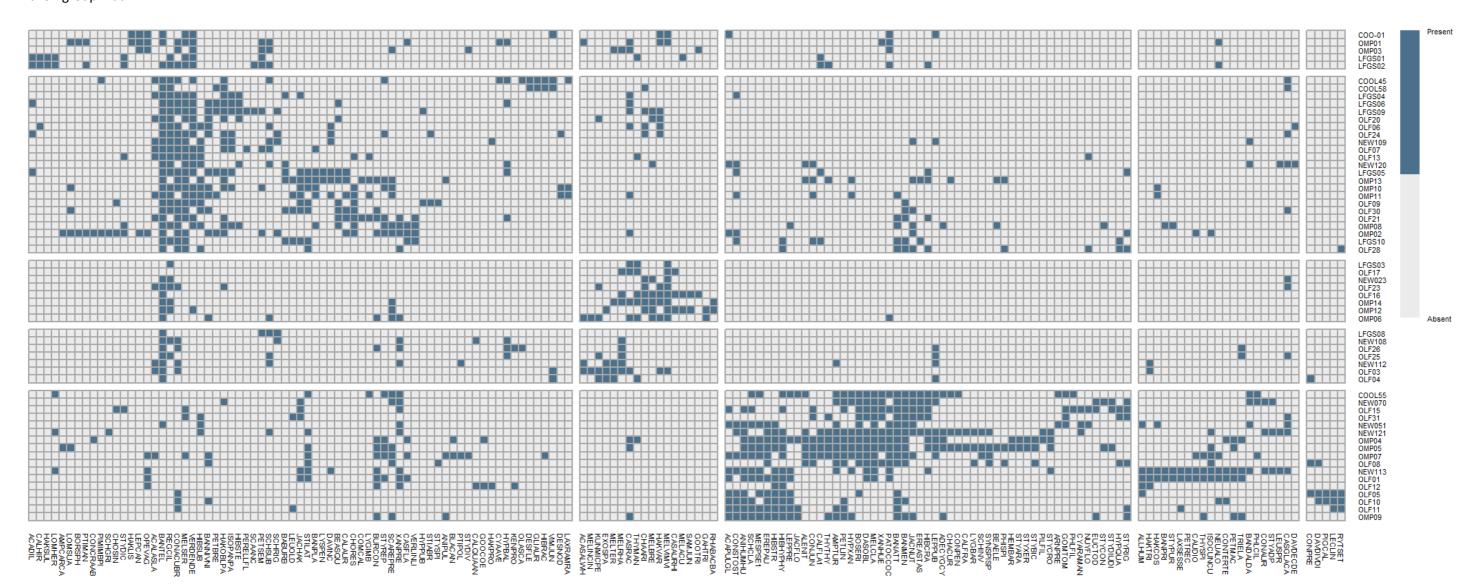


2D cluster plot





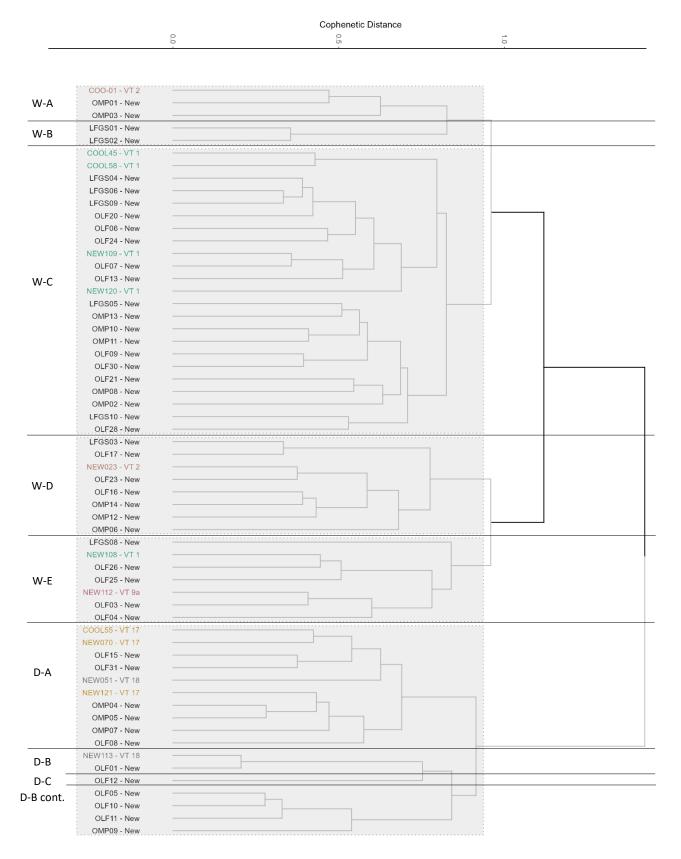
Taxon group matrix

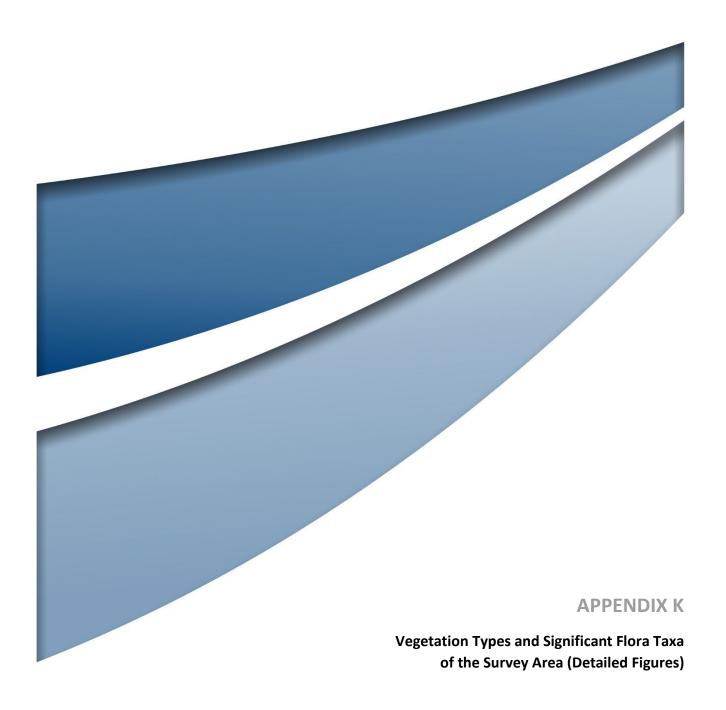


Detailed Flora and Vegetation Assessment 22834_R01_Osprey-Baseline-Flora-and-Vegetation_FINAL_V2



Agglomerative hierarchical clustering analysis dendrogram (including Cooljarloo West VTs for existing quadrats; indicated after site name, and label colour-coded according to VT), with final VT determinations (annotated to the left of dendrogram and separated with black horizontal lines)

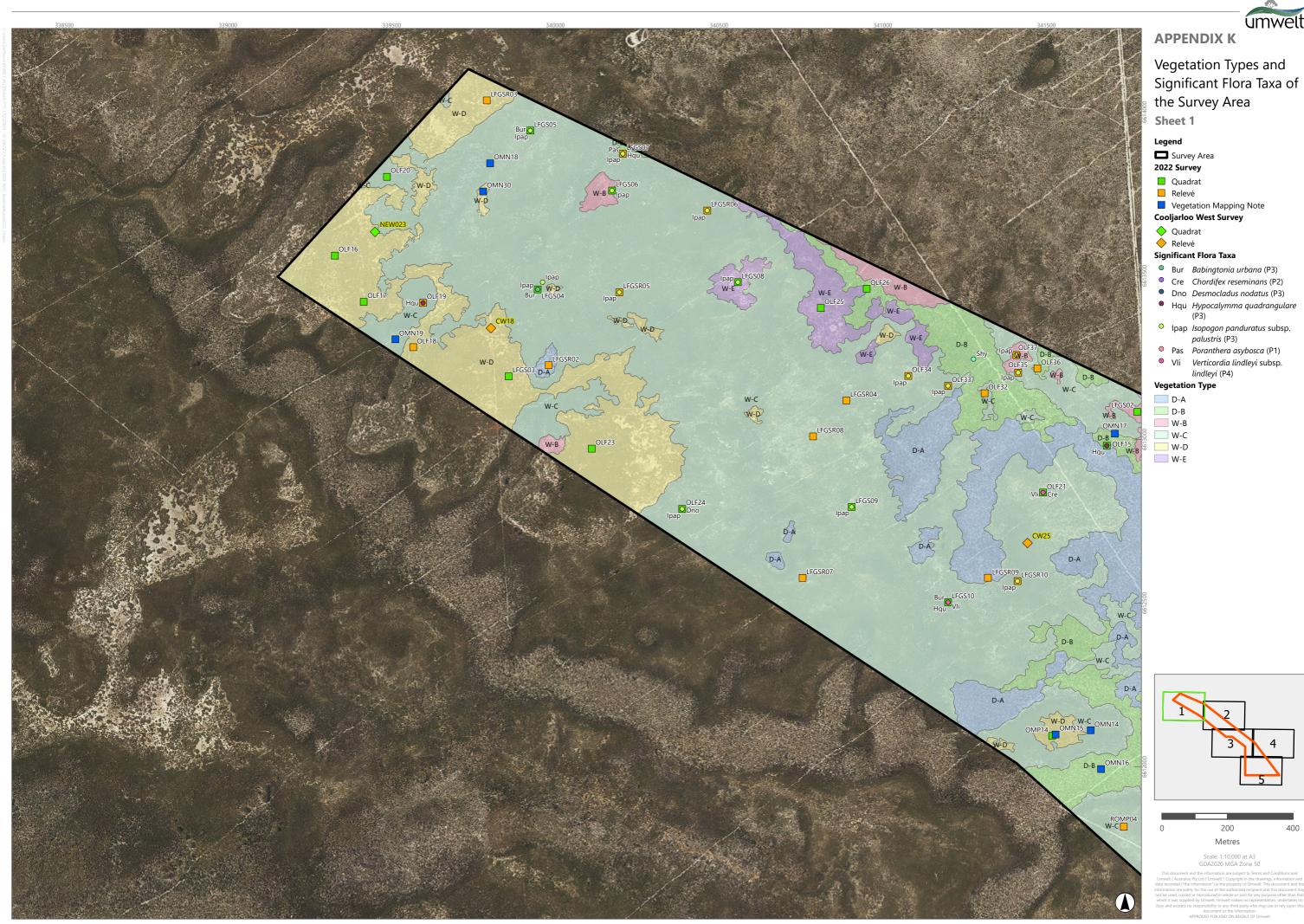




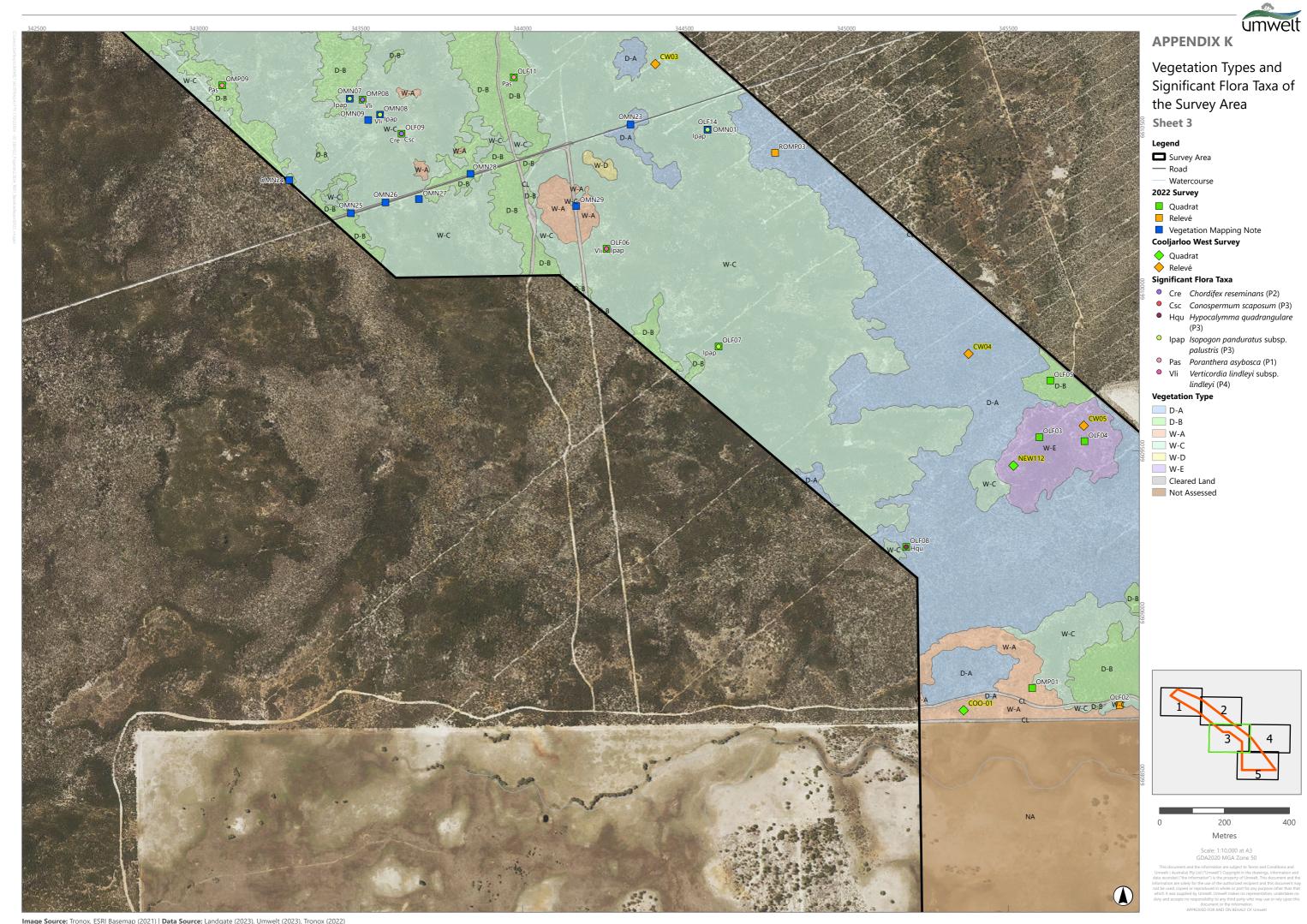
GOVERNMENT AGENCY REFERENCE ONLY

NOT FOR PUBLIC DISSEMINATION

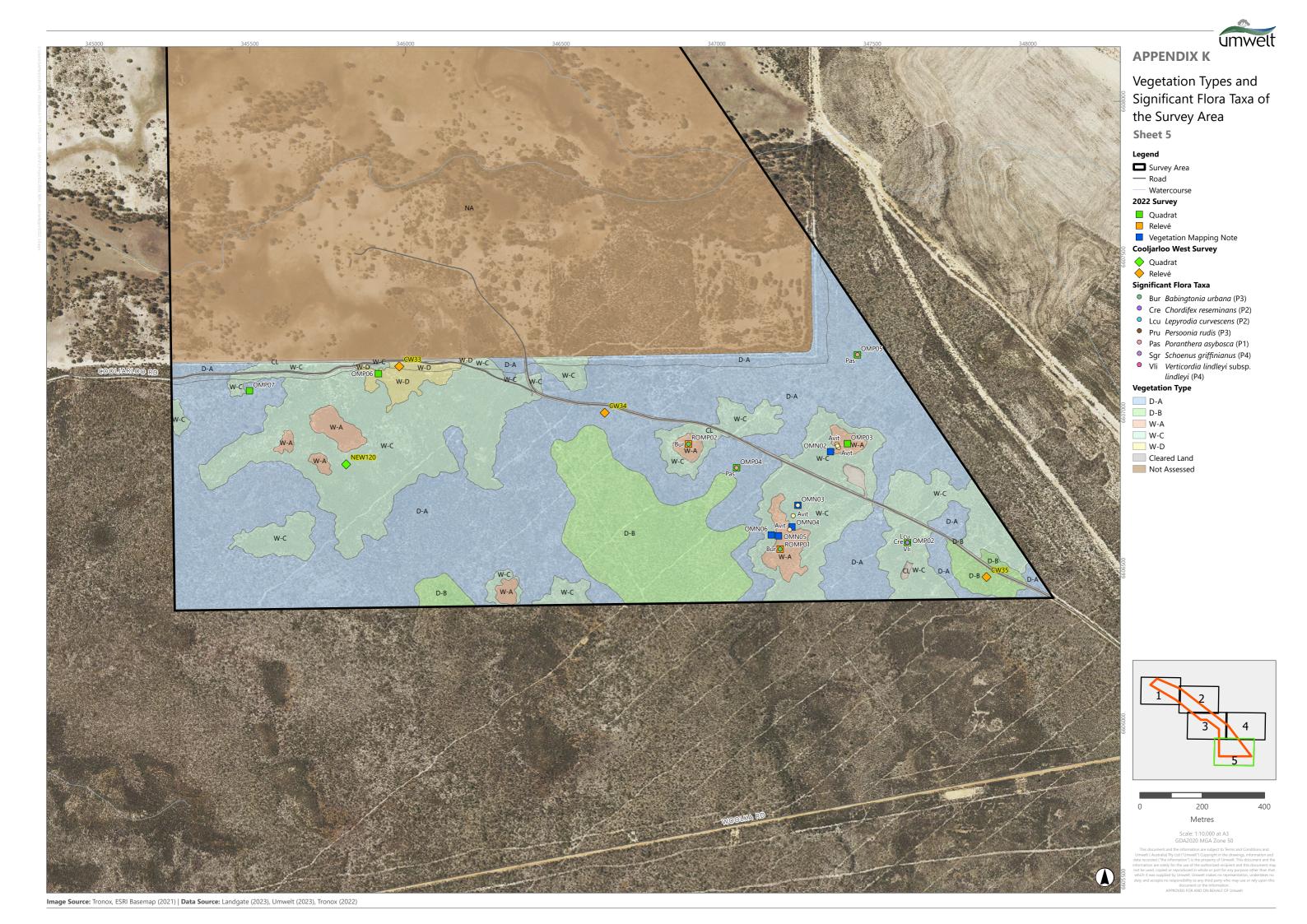
CONTAINS LOCATIONS OF SIGNIFICANT FLORA TAXA













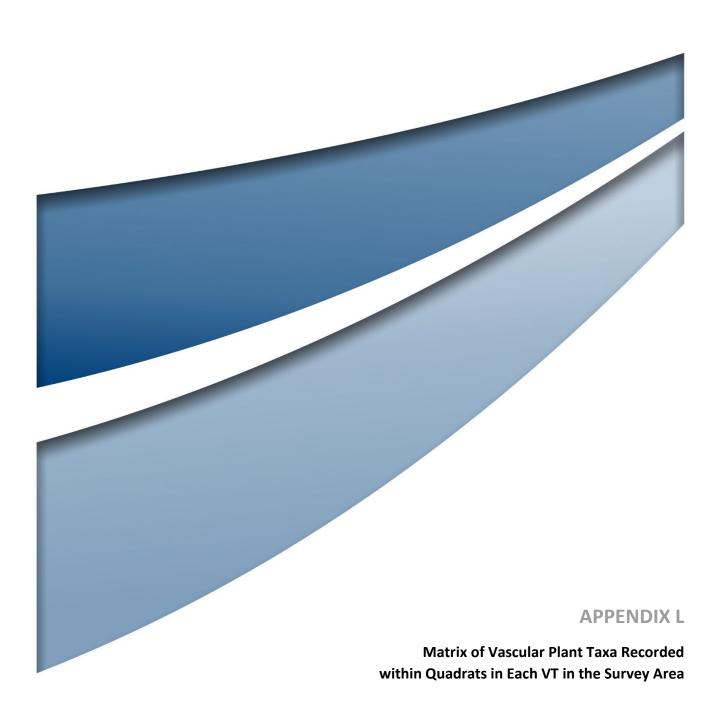
Legend **Significant Flora Taxa** Dno Desmocladus nodatus (P3) Pru Persoonia rudis (P3) Gcoo Grevillea cooljarloo (P1) Pas Poranthera asybosca (P1) Avit Anigozanthos viridis subsp. terraspectans (T) Babingtonia urbana (P3) Hqu Hypocalymma quadrangulare (P3) Schoenus griffinianus (P4) O Ipap Isopogon panduratus subsp. palustris (P3) Chordifex reseminans (P2) Stylidium hymenocraspedum (P3) Conospermum scaposum (P3) Lcu Lepyrodia curvescens (P2) Verticordia lindleyi subsp. lindleyi (P4) **Vegetation Type** D-A Low woodland to isolated trees of Banksia attenuata and Banksia menziesii, occasionally with Eucalyptus todtiana and Nuytsia floribunda, over mid isolated shrubs of Xanthorrhoea preissii, over low shrubland to sparse shrubland of mixed species dominated by Bossiaea eriocarpa and Melaleuca clavifolia and also Hibbertia hypericoides subsp. hypericoides, Jacksonia nutans and Eremaea pauciflora var. pauciflora, over low sparse sedgeland and rushland of mixed species including Lepidosperma cf. pubisquameum, Alexgeorgea nitens and Mesomelaena pseudostygia, over low sparse forbland of mixed species including Dasypogon obliquifolius and Patersonia occidentalis var. occidentalis, on grey or brown deep sands or sandy loam on plains or flats within undulating plains and slopes of low dunes. D-B Low woodland to isolated trees of Banksia attenuata and Banksia menziesii, occasionally with Eucalyptus todtiana or Banksia prionotes, over mid open to sparse shrubland of mixed species dominated by Allocasuarina humilis, Eremaea pauciflora var. pauciflora, Acacia pulchella var. qlaberrima and occasionally Hakea trifurcata and Xanthorrhoea preissii, over low open to sparse shrubland of mixed species dominated by Hibbertia hypericoides subsp. hypericoides, Conospermum stoechadis subsp. stoechadis. Hibbertia striata. Stirlingia latifolia and occasionally Petrophile macrostachya, over low sparse sedgeland and rushland of mixed species including Lepidobolus preissianus subsp. preissianus and Mesomelaena pseudostygia, on yellow-brown or grey deep sands or sandy loam on flats within undulating plains and slopes of low dunes. D-C Mid open shrubland of mixed species dominated by Hakea trifurcata, Banksia sessilis var. cygnorum, Xanthorrhoea preissii and Allocasuarina humilis, over low sparse shrubland of mixed species dominated by Calothamnus quadrifidus subsp. angustifolius and to a lesser extent Hibbertia hypericoides subsp. hypericoides, Hakea prostrata and Hibbertia striata, on red-brown clay loam with ironstone surface stones and outcropping on low rocky hills. W-A Occasional low isolated trees of Melaleuca rhaphiophylla over mid heathland to open heathland of mixed species including Melaleuca viminea subsp. viminea, Hakea varia, Melaleuca teretifolia and Viminaria juncea, over low sparse heathland of mixed species dominated by Verticordia densiflora var. densiflora, Melaleuca seriata and sometimes Hakea lissocarpha, Petrophile seminuda and Banksia telmatiaea, over low sparse sedgeland and rushland of mixed species dominated by Leptocarpus canus and Schoenus subfascicularis over low sparse forbland of mixed species including Patersonia occidentalis var. occidentalis, Opercularia vaginata and Conostylis aculeata subsp. breviflora, on sandy clay loam or clay loam of various colours on seasonally damp to wet lower slopes, open depressions and clay pans. W-B Mid sparse heathland of mixed species including Verticordia plumosa var. brachyphylla and Melaleuca acutifolia, over low heathland of mixed species dominated by Regelia ciliata, Calothamnus hirsutus, Melaleuca seriata, Verticordia densiflora var. densiflora and Petrophile seminuda, on brown or grey sandy loam on seasonally damp undulating plains. W-C Occasional low open woodland to isolated trees of mixed species including Nuytsia floribunda, Banksia menziesii, Banksia attenuata, Banksia prionotes and Melaleuca preissiana, over mid closed to open heathland of mixed species dominated by Banksia telmatiaea, Regelia ciliata, Hakea obliqua subsp. parviflora and occasionally Beaufortia squarrosa and Calytrix aurea, over low heathland to sparse heathland of mixed species including Melaleuca seriata, Verticordia densiflora var. densiflora, Isopogon panduratus subsp. palustris (P3), Acacia lasiocarpa var. lasiocarpa and Jacksonia hakeoides, on grey, brown or yellow sandy loam or sand on seasonally damp to wet low-lying plains, flats, open depressions and swamps. W-D Occasional low isolated trees of Melaleuca rhaphiophylla, over mid heathland to open heathland of mixed species dominated by Melaleuca viminea subsp. viminea, Banksia telmatiaea, Regelia ciliata and occasionally Melaleuca acutifolia and Kunzea micrantha subsp. petiolata, over low open to sparse heathland of mixed species including Melaleuca brevifolia and Hakea varia, over low sparse sedgeland and rushland of mixed species including Chaetanthus aristatus and occasionally Gahnia trifida, on brown, grey or black clay loam or sandy loam on damp to wet plains, flats and open depressions. W-E Occasional low isolated trees of Melaleuca rhaphiophylla, Eucalyptus rudis subsp. rudis, Banksia littoralis and/or Banksia menziesii, over tall sparse to isolated shrubs of mixed species including Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602), Exocarpos sparteus and occasionally Viminaria juncea, Melaleuca incana subsp. incana and Hakea varia, over mid open to sparse heathland of Banksia telmatiaea and other species including Kunzea micrantha subsp. petiolata, Regelia ciliata, Melaleuca teretifolia and Hakea trifurcata, over low sparse shrubland of mixed species including Xanthorrhoea preissii, Hypocalymma balbakiae, Melaleuca viminea subsp. viminea and Acacia lasiocarpa var. lasiocarpa, on brown or grey clay loam or sandy loam on damp to wet flats or plains. Cleared Land Cleared Land Not Assessed Not Assessed

APPENDIX K

LEGEND: Vegetation Types and Significant Flora Taxa of the Survey Area

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PPROVED FOR AND ON BEHALF OF Umwelt





Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Acacia applanata							Х	
Acacia cyclops							Х	
Acacia dilatata					Х	Х		
Acacia lasiocarpa var. lasiocarpa	Х					Х	Х	Х
Acacia pulchella var. reflexa	Х	Х				Х		
Acacia pulchella var. glaberrima	Х	Х				Х		
Acacia pulchella var. pulchella				Х				
Acacia saligna subsp. Wheatbelt (B.R. Maslin 8602)				Х			Х	Х
Acacia sphacelata subsp. verticillata	Х							
Actinotus leucocephalus	Х	Х						
Adenanthos cygnorum subsp. cygnorum	Х	Х				Х		
*Aira caryophyllea subsp. caryophyllea			Х		Х	Х	Х	Х
*Aira cupaniana				Х			Х	Х
Alexgeorgea nitens	Х					Х		
Alexgeorgea subterranea	Х							
Allocasuarina humilis	Х	Х	Х					
Allocasuarina lehmanniana subsp. lehmanniana							Х	
Amphipogon caricinus var. caricinus	Х					Х		
Amphipogon turbinatus	Х	Х						Х
Anarthria grandiflora						Х		
Anarthria laevis							Х	
?Angianthus tomentosus							Х	
Anigozanthos humilis subsp. humilis	Х	Х						
Anigozanthos pulcherrimus	Х	Х				Х		
Anigozanthos viridis subsp. Cataby (S.D. Hopper 1786)						Х		



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Apectospermum spinescens		Х						
Aphelia cyperoides	Х					Х		Х
Aphelia nutans					Х			
*Arctotheca calendula	Х	Х	Х			Х		Х
Arnocrinum preissii	Х							
Austrostipa compressa	Х	Х		Х	Х	Х		Х
Austrostipa macalpinei	Х	Х				Х		Х
*Avellinia festucoides			Х				Х	
Babingtonia urbana (P3)						Х		
Banksia attenuata	Х	Х				Х		
Banksia dallanneyi subsp. dallanneyi var. dallanneyi	Х	Х				Х		
Banksia littoralis								Х
Banksia menziesii	Х	Х				Х		Х
Banksia nivea subsp. nivea	Х	Х				Х	Х	
Banksia platycarpa						Х		Х
Banksia prionotes	Х	Х				Х		
Banksia sessilis var. cygnorum			Х					
Banksia telmatiaea	Х			Х	Х	Х	Х	Х
Beaufortia elegans	Х					Х		
Beaufortia squarrosa						Х		
Blancoa canescens	Х							
Blennospora drummondii	Х			Х		Х		
Borya sphaerocephala				Х		Х		
Bossiaea eriocarpa	Х	Х	Х					
Brachyscome bellidioides		Х				Х		



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Brachyscome pusilla				Х	Х		Х	
*Briza maxima				Х				Х
*Briza minor				Х				Х
Burchardia congesta	Х	Х	Х			Х	Х	Х
Caladenia flava subsp. flava	Х	Х	Х	Х		Х	Х	
Caladenia longicauda subsp. albella				Х		Х	Х	
Calandrinia corrigioloides	Х	Х	Х					
Calandrinia granulifera		Х				Х	Х	
Calandrinia sp. Kenwick (G.J. Keighery 10905)							Х	
Calothamnus hirsutus					Х	Х		
Calothamnus quadrifidus subsp. angustifolius			Х			Х		Х
Calothamnus quadrifidus subsp. quadrifidus								Х
Calytrix aurea						Х		
Calytrix flavescens	Х				Х	Х		
Calytrix fraseri	Х	Х						
Carpobrotus virescens							Х	
Cassytha aurea var. hirta							Х	
Cassytha flava	Х	Х		Х		Х		
Cassytha glabella forma bicallosa						Х		
Cassytha glabella forma dispar	Х	Х				Х	Х	
Cassytha glabella forma casuarinae	Х					Х	Х	Х
Cassytha racemosa forma pilosa	Х	Х		Х		Х	Х	
Cassytha racemosa forma racemosa							Х	Х
Caustis dioica	Х	Х				Х		
Centrolepis aristata				Х	Х	Х	Х	Х



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Centrolepis drummondiana	Х	Х				Х		Х
Centrolepis mutica	Х							
Centrolepis pilosa	Х							Х
Centrolepis polygyna		Х				Х	Х	Х
Chaetanthus aristatus						Х	Х	
Chaetospora curvifolia	Х					Х		
Chamaescilla versicolor				Х				
Chamelaucium uncinatum						Х		
Chordifex reseminans (P2)						Х		
Chordifex sinuosus	Х					Х		
*Cicendia filiformis				Х			Х	
Clematis linearifolia							Х	
Comesperma calymega						Х		
Conospermum scaposum (P3)						Х		
Conospermum stoechadis subsp. stoechadis	Х	Х				Х		Х
Conospermum teretifolium	Х							
Conostephium pendulum	Х							
Conostephium preissii	X	Х						Х
Conostylis aculeata subsp. breviflora				Х		Х		
Conostylis aculeata subsp. spinuligera		Х			Х	Х	Х	Х
Conostylis angustifolia	Х							
Conostylis aurea	Х	Х						
Conostylis crassinerva subsp. absens	Х					Х		
Conostylis juncea	Х					Х		
Conostylis prolifera					Х			



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Conostylis teretifolia subsp. teretifolia	Х	Х						
Corynotheca micrantha		Х						
Cotula cotuloides							Х	
Crassula closiana				Х	Х		Х	
Crassula colorata var. acuminata							Х	
Crassula exserta		Х	Х	Х		Х	Х	Х
Cryptandra pungens		Х						
Cyanothamnus ramosus subsp. anethifolius	Х							
Cyathochaeta avenacea				Х		Х		
Dampiera linearis	Х							
Dampiera teres					Х			
Darwinia pinifolia				Х				
Dasypogon obliquifolius	Х	Х						
Daucus glochidiatus			Х					
Daviesia decurrens subsp. decurrens						Х		
Daviesia divaricata subsp. divaricata	Х	Х						
Daviesia incrassata subsp. incrassata		Х				Х		
Daviesia incrassata subsp. teres						Х		
Desmocladus asper			Х					
Desmocladus ?flexuosus						Х		
Desmocladus lateriflorus						Х		
Desmocladus nodatus (P3)						Х		
Drosera drummondii	Х	Х					Х	
Drosera eneabba	Х	Х						
Drosera erythrorhiza	Х	Х				Х		



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Drosera gigantea				Х	Х	Х		
Drosera glanduligera				Х	Х	Х	Х	Х
Drosera humilis	Х	Х						
Drosera ?magna		Х						
Drosera menziesii	Х	Х		Х	Х	Х		Х
Drosera minutiflora	Х	Х						
Drosera thysanosepala		Х						
*Ehrharta calycina				Х				
Elythranthera brunonis						Х		
Eremaea asterocarpa subsp. asterocarpa	Х					Х		Х
Eremaea beaufortioides var. beaufortioides	Х							
Eremaea pauciflora var. lonchophylla		Х						
Eremaea pauciflora var. pauciflora	Х	Х						
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459) (P3)				Х				
Eucalyptus rudis subsp. rudis								X
Eucalyptus todtiana	Х	Х						
Euchiton sphaericus			X				Х	Х
Exocarpos sparteus				Х			Х	Х
*Ficinia marginata		Х	Х			Х	Х	
Gahnia trifida							Х	
*Galium murale			Х					
*Gladiolus caryophyllaceus	Х	Х				Х		
Glischrocaryon aureum						Х		
Gnephosis drummondii				Х		Х		
Gompholobium tomentosum	Х							



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Gonocarpus nodulosus				Х				
Gonocarpus pithyoides						Х		
Goodenia coerulea	Х		Х					
Goodenia micrantha				Х			Х	
Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)						Х	Х	Х
Goodenia trinervis				Х		Х	Х	
Grevillea cooljarloo (P1)							Х	
Gyrostemon subnudus		Х						
Haemodorum simplex				Х				
Haemodorum spicatum	Х			Х				
Hakea costata	Х	Х				Х		
Hakea lissocarpha				Х				
Hakea obliqua subsp. parviflora	Х					Х	Х	Х
Hakea prostrata			Х			Х		
Hakea ruscifolia		Х						
Hakea sulcata					Х			
Hakea trifurcata		Х	Х					Х
Hakea varia				Х		Х	Х	Х
*Heliophila pusilla			Х			Х	Х	
Hemiandra linearis	Х							
Hemiandra pungens	Х							
Hemiphora bartlingii	Х							
Hibbertia crassifolia	Х	Х			Х	Х		
Hibbertia hypericoides subsp. hypericoides	Х	Х	Х			Х		
Hibbertia pubens	Х							



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Hibbertia racemosa	Х					Х		
Hibbertia ?sericosepala	Х							
Hibbertia stellaris						Х		
Hibbertia striata	Х	Х	Х					
Hibbertia subvaginata	Х					Х		
Homalosciadium homalocarpum							Х	
Hovea pungens						Х		
Hyalosperma cotula				Х				
Hydrocotyle alata				Х			Х	
Hydrocotyle callicarpa						Х	Х	
Hypocalymma balbakiae				Х		Х		Х
Hypocalymma quadrangulare (P3)	Х	Х				Х		
Hypocalymma suave						Х		
Hypocalymma xanthopetalum	Х	Х				Х		
*Hypochaeris glabra	Х	Х	Х	Х	Х	Х	Х	Х
Hypolaena pubescens						Х		
Isopogon panduratus subsp. palustris (P3)						Х		X
Isotropis cuneifolia subsp. cuneifolia	Χ	Х				Х		
Jacksonia floribunda	Х	Х						
Jacksonia hakeoides	Х	Х				Х		
Jacksonia nutans	Х	Х				Х		
Jacksonia sternbergiana	Х							Х
Johnsonia pubescens subsp. pubescens	Х							
*Juncus capitatus				Х			Х	
Kennedia prostrata			Х					Х



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Kunzea micrantha subsp. petiolata					Х	Х	Х	Х
Lasiopetalum lineare	Х							
Laxmannia ramosa subsp. ramosa						Х		
Laxmannia sessiliflora subsp. ?australis		Х						
Laxmannia sessiliflora subsp. sessiliflora		Х						
Lechenaultia linarioides		Х						
Lechenaultia stenosepala	Х							
Lepidobolus preissianus subsp. preissianus	Х	Х				Х		
Lepidosperma apricola	Х							
Lepidosperma longitudinale						Х		
Lepidosperma pubisquameum	Х			Х		Х		Х
Lepidosperma cf. pubisquameum	Х							Х
Lepidosperma aff. scabrum		Х						
Leptocarpus canus				Х		Х		
Lepyrodia curvescens (P2)						Х		
Leucopogon oldfieldii	Х	Х				Х		
Leucopogon oliganthus						Х		
Leucopogon parviflorus		Х						
Leucopogon sprengelioides	Х	Х				Х		
Leucopogon stenophyllus						Х		
Levenhookia pusilla								Х
Levenhookia stipitata	Х					Х	Х	Х
Lobelia rhytidosperma								Х
Lomandra hermaphrodita	Х	Х			Х			
Lomandra preissii	Х							



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Lomandra suaveolens	Х			Х		Х		
Lyginia barbata	Х							
Lyginia imberbis	Х					Х		
*Lysimachia arvensis		Х	Х	Х			Х	Х
Lysinema pentapetalum						Х	Х	
Macarthuria australis		Х						
Macrozamia fraseri		Х						
Melaleuca acutifolia					Х		Х	
Melaleuca brevifolia					Х	Х	Х	
Melaleuca clavifolia	Х	Х						
Melaleuca incana subsp. incana							Х	Х
Melaleuca preissiana						Х		
Melaleuca rhaphiophylla				Х		Х	Х	Х
Melaleuca seriata	Х			Х	Х	Х		Х
Melaleuca teretifolia				Х			Х	Х
Melaleuca viminea subsp. viminea				Х		Х	Х	Х
Mesomelaena pseudostygia	Х	Х						
?Microtis sp.								Х
Millotia myosotidifolia			Х				Х	Х
Neurachne alopecuroidea	Х	Х		Х	Х			
Nuytsia floribunda	Х					Х	Х	
Olax scalariformis						Х		Х
Olearia axillaris							Х	
Opercularia vaginata	Х	Х	Х	Х		Х		
*Ornithopus compressus		Х		Х				



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
*Ornithopus sativus		Х						
*Orobanche minor							Х	
Panaetia lessonii				Х			Х	
?Paracaleana sp.	Х							
*Parentucellia latifolia				Х				X
Patersonia occidentalis var. occidentalis	Х	Х		Х	Х		Х	
*Pentameris airoides subsp. airoides	Х			Х		Х	Х	Х
Pericalymma ellipticum var. floridum						Х		
Pericalymma spongiocaule						Х		
Persoonia comata	Х							
Persoonia rudis (P3)						Х		
Persoonia trinervis	Х							
Petrophile brevifolia sens. lat.						Х		
Petrophile linearis	Х	Х						
Petrophile macrostachya	Х	Х						
Petrophile recurva		Х						
Petrophile seminuda				Х	Х	Х		Х
Philotheca spicata	Х					Х		
Philydrella pygmaea subsp. pygmaea				Х	Х			
Phlebocarya ciliata	Х							
Phlebocarya filifolia	Х							
Phyllangium divergens	Х	Х	Х			Х	Х	Х
Pigea calycina		Х						
Pileanthus filifolius	Х							
Pimelea imbricata var. piligera					Х	Х		



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Pimelea sulphurea	Х							
Podolepis gracilis				Х				Х
Podotheca angustifolia	Х	Х			Х	Х	Х	Х
Podotheca chrysantha		Х						
Podotheca gnaphalioides	Х	Х	Х	Х		Х	Х	Х
Pogonolepis stricta				Х				Х
Polypogon tenellus				Х				
Poranthera asybosca (P1)	Х	Х						
Poranthera drummondii	Х							Х
Poranthera microphylla							Х	
Pterochaeta paniculata	Х	Х				Х		
Pterostylis vittata		Х						
Ptilotus manglesii				Х	Х	Х		
Ptilotus polystachyus	Х							Х
Pyrorchis nigricans		Х				Х		
Quinetia urvillei	Х			Х				
Quoya verbascina		Х						
Regelia ciliata					Х	Х	Х	Х
Rhagodia baccata subsp. baccata							Х	
Rytidosperma ?occidentale	Х							
Rytidosperma setaceum		Х				Х		
*Sagina apetala							Х	
Samolus junceus			_				Х	
Scaevola anchusifolia					Х	Х		
Scaevola canescens		Х						



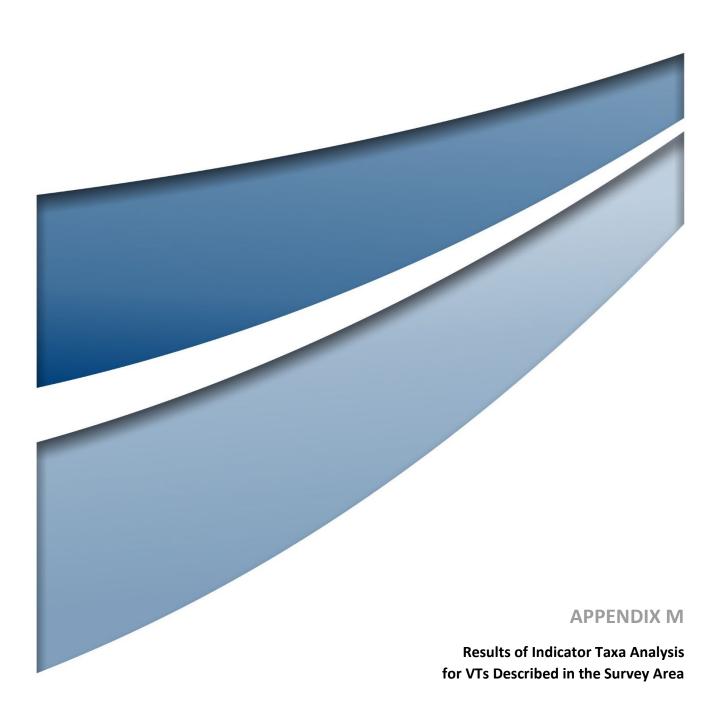
Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Scaevola ?lanceolata						Х		
Scaevola repens var. repens	Х	Х		Х		Х	Х	
Schoenus brevisetis						Х		
Schoenus clandestinus	Х	Х						
Schoenus griffinianus (P4)	Х					Х		
Schoenus odontocarpus				Х				
Schoenus ?pedicellatus	Х							
Schoenus pleiostemoneus		Х						
Schoenus rigens						Х		Х
Schoenus subfascicularis	Х			Х	Х	Х	Х	Х
Schoenus subflavus				Х				
Scholtzia involucrata	Х							
Senecio pinnatifolius var. latilobus							Х	
Siloxerus humifusus	Х	Х		Х	Х	Х	Х	Х
Siloxerus multiflorus				Х			Х	Х
*Sonchus oleraceus			Х				Х	Х
Sowerbaea laxiflora		Х		Х				
Spergularia brevifolia							Х	
Stackhousia ?monogyna	Х							
Stirlingia abrotanoides						Х		
Stirlingia latifolia	Х	Х				Х		
Stylidium adpressum	Х	Х						
Stylidium androsaceum							Х	
Stylidium araeophyllum	Х							
Stylidium bicolor	Х							



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Stylidium calcaratum				Х	Х	Х		
Stylidium crossocephalum	Х	Х						
Stylidium cygnorum	Х							
Stylidium dichotomum	Х				Х	Х		
Stylidium diuroides subsp. diuroides	Х							
Stylidium divaricatum	Х			Х				
Stylidium obtusatum				Х				
Stylidium perpusillum						Х		
Stylidium petiolare					Х	Х		
Stylidium purpureum		Х				Х		
Stylidium repens	Х	Х				Х		
Stylidium rigidulum	Х	Х				Х		
Stylidium spiciforme	Х					Х		
Styphelia conostephioides	Х					Х		
Styphelia glaucifolia					Х			
Styphelia microdonta	Х							
Styphelia tortifolia						Х		
Styphelia xerophylla	Х							
Synaphea spinulosa subsp. spinulosa	Х							
Thelymitra vulgaris				Х				
Thryptomene hyporhytis				Х				
Thysanotus manglesianus					Х	Х	Х	Х
Thysanotus patersonii	Х							
Thysanotus spiniger	Х	Х						
Thysanotus thyrsoideus	Х	Х			Х	Х		



Taxon	D-A	D-B	D-C	W-A	W-B	W-C	W-D	W-E
Trachymene pilosa	Х	Х	Х		Х	Х	Х	Х
Tribonanthes australis				Х				
Tribonanthes variabilis				Х	Х			
Tricoryne elatior	Х	Х						Х
*Trifolium arvense var. arvense							Х	
Triglochin nana	Х							
Tripterococcus brunonis						Х		
*Ursinia anthemoides subsp. anthemoides	Х	Х	Х	Х	Х	Х	Х	Х
Utricularia multifida				Х				
Verticordia densiflora var. densiflora	Х			Х	Х	Х	Х	
Verticordia lindleyi subsp. lindleyi (P4)						Х		
Verticordia plumosa var. brachyphylla					Х			
Viminaria juncea				Х		Х		Х
*Vulpia myuros forma myuros	Х		Х	Х		Х	Х	Х
*Wahlenbergia capensis	Х	Х	X			Х	Х	Х
Wahlenbergia gracilenta	Х							
Wahlenbergia preissii	Х						Х	
Waitzia acuminata var. albicans	Х	Х		Х				
Waitzia nitida						Х		
Waitzia suaveolens var. suaveolens	Х	Х						
Wurmbea dioica subsp. alba				Х			Х	
Xanthorrhoea preissii	Х	Х	Х	Х		Х	Х	Х
Xanthosia huegelii	Х			Х				





Note: INDVAL values are only shown for taxa that are significant at p < 0.05.

p values are indicated by:

^{*** =} p < 0.001.

VT	Taxon	INDIVAL (%)	p Value	Significance
D-A	Alexgeorgea nitens	0.52405	0.01480	*
	Amphipogon turbinatus	0.44356	0.04001	*
	Banksia attenuata	0.53077	0.00020	***
	Banksia menziesii	0.64486	0.00020	***
	Bossiaea eriocarpa	0.85714	0.00020	***
	Conostylis juncea	0.46517	0.02420	*
	Dasypogon obliquifolius	0.65676	0.00060	***
	Eremaea asterocarpa subsp. asterocarpa	0.42593	0.02020	*
	Gompholobium tomentosum	0.40000	0.01540	*
	Hypocalymma xanthopetalum	0.35284	0.04461	*
	Jacksonia nutans	0.43458	0.03741	*
	Melaleuca clavifolia	0.75000	0.00020	***
	Petrophile linearis	0.49231	0.03001	*
	Synaphea spinulosa subsp. spinulosa	0.40000	0.01300	*
	Xanthosia huegelii	0.56471	0.01360	*
D-B	Acacia pulchella var. glaberrima, Acacia pulchella var. pulchella, Acacia pulchella var. reflexa	0.58130	0.00260	***
	Allocasuarina humilis	0.41667	0.01860	*
	Anigozanthos humilis subsp. humilis	0.62500	0.00080	***
	Conospermum stoechadis subsp. stoechadis	0.49809	0.01120	*
	Conostylis teretifolia subsp. teretifolia	0.41667	0.01420	*
	Eremaea pauciflora var. lonchophylla, Eremaea pauciflora var. pauciflora	0.48450	0.02801	*
	Hibbertia striata	0.71429	0.00020	***
	Hibbertia hypericoides subsp. hypericoides	0.59278	0.00020	***
	Laxmannia sessiliflora subsp. ?australis, Laxmannia sessiliflora subsp. sessiliflora	0.50000	0.00760	**
	Lechenaultia linarioides	0.50000	0.00820	**
	Lepidobolus preissianus subsp. preissianus	0.80420	0.00020	***
	Mesomelaena pseudostygia	0.52083	0.02160	*
	Petrophile macrostachya	0.35714	0.02841	*
	Rytidosperma setaceum	0.46000	0.01180	*
	Schoenus clandestinus	0.48450	0.03061	*
	Thysanotus spiniger	0.41667	0.01280	*

^{* =} *p* < 0.05

^{** =} p < 0.01



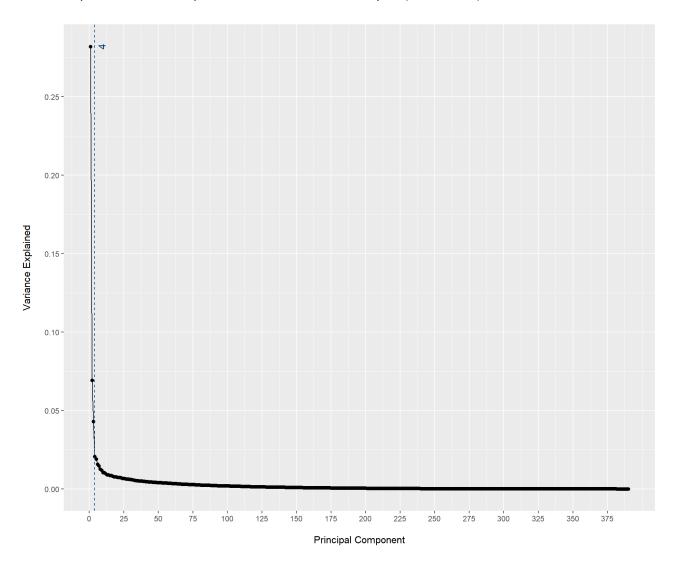
VT	Taxon	INDIVAL (%)	p Value	Significance
W-A	Hakea lissocarpha	0.66667	0.00240	***
	Leptocarpus canus	0.95833	0.00020	***
	Opercularia vaginata	0.67713	0.00800	**
	Verticordia densiflora var. densiflora	0.35453	0.03701	*
W-B	Acacia dilatata	0.88462	0.00040	***
	Calothamnus hirsutus	0.95833	0.00140	***
	Calytrix flavescens	0.67251	0.00460	***
	Hakea sulcata	1.00000	0.00100	***
	Lomandra hermaphrodita	0.73171	0.00460	***
	Melaleuca seriata	0.35807	0.00080	***
	Petrophile seminuda	0.50418	0.02140	*
	Regelia ciliata	0.36539	0.00080	***
	Scaevola anchusifolia	0.46000	0.03221	*
	Stylidium dichotomum	0.81272	0.00080	***
W-C	Banksia telmatiaea	0.24896	0.00340	***
	Beaufortia squarrosa	0.34783	0.04861	*
	Hakea obliqua subsp. parviflora	0.48489	0.00100	***
	Isopogon panduratus subsp. palustris (P3)	0.39130	0.03381	*
W-D	Cassytha aurea var. hirta	0.37500	0.03981	*
	Chaetanthus aristatus	0.48895	0.02260	*
	Melaleuca brevifolia	0.51709	0.01900	*
	Melaleuca viminea subsp. viminea	0.55263	0.00840	**
W-E	Melaleuca rhaphiophylla	0.35864	0.03681	*



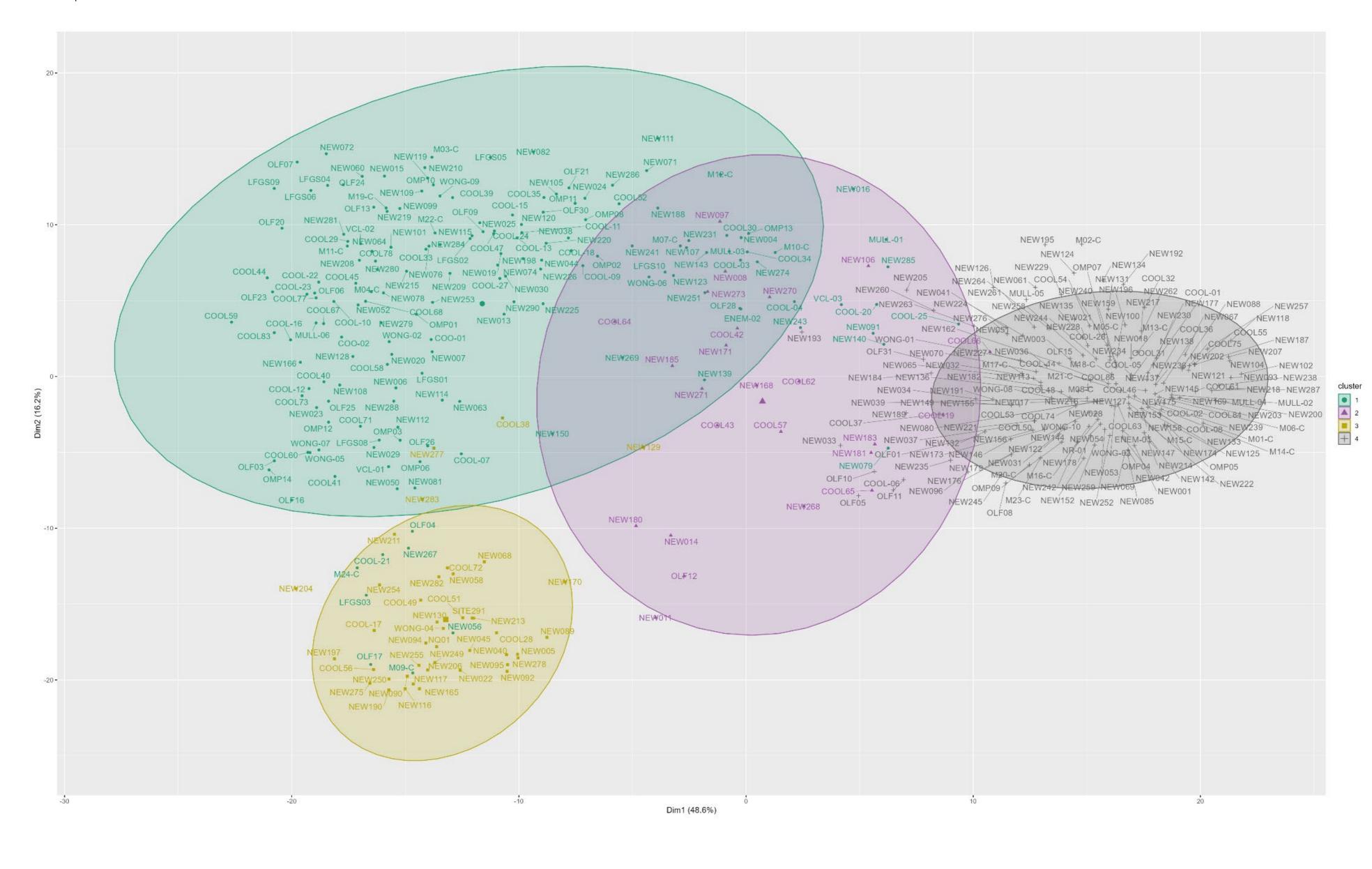


Analysis three: combined 2022 and existing Cooljarloo West quadrat data

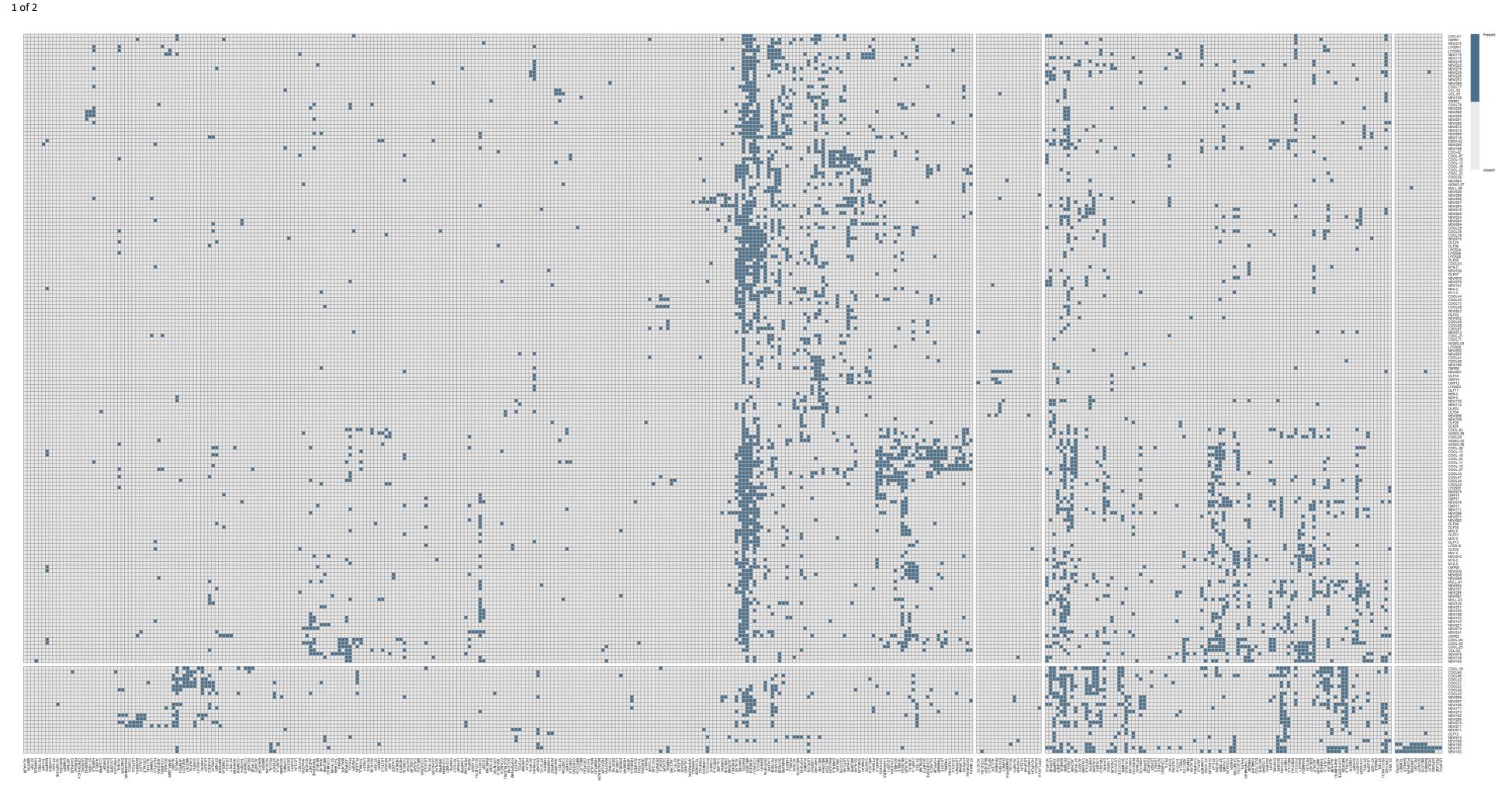
PCA scree plot and result of optimal number of clusters analyses (dashed line)



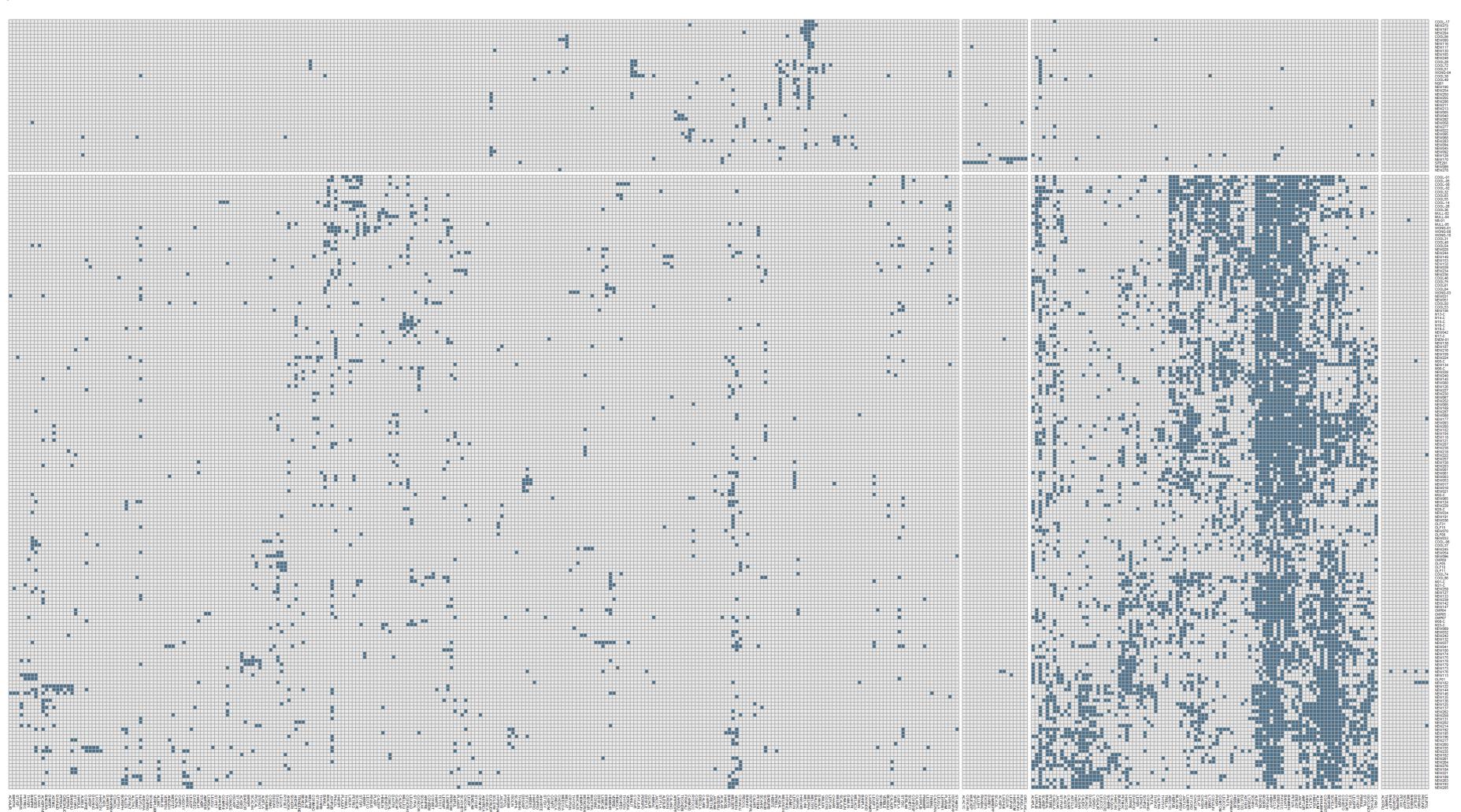








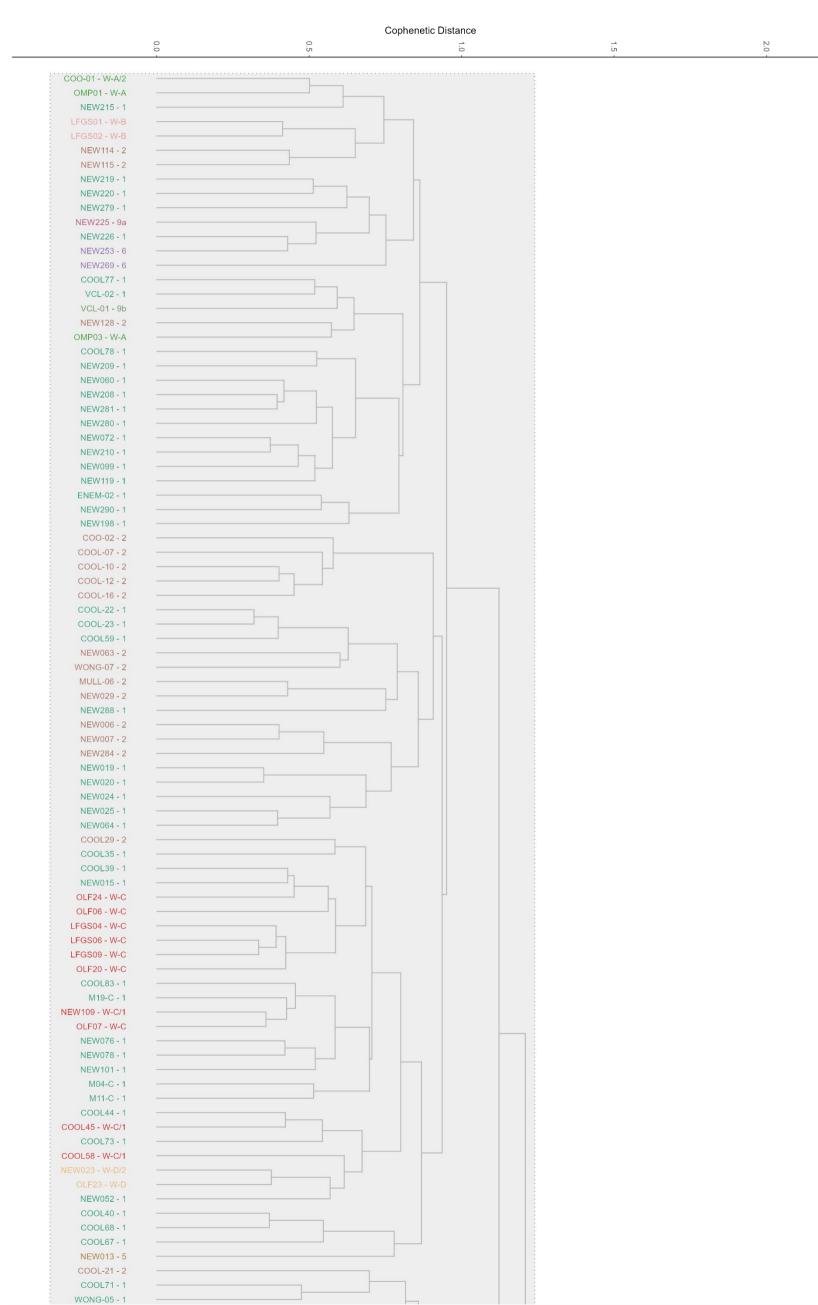




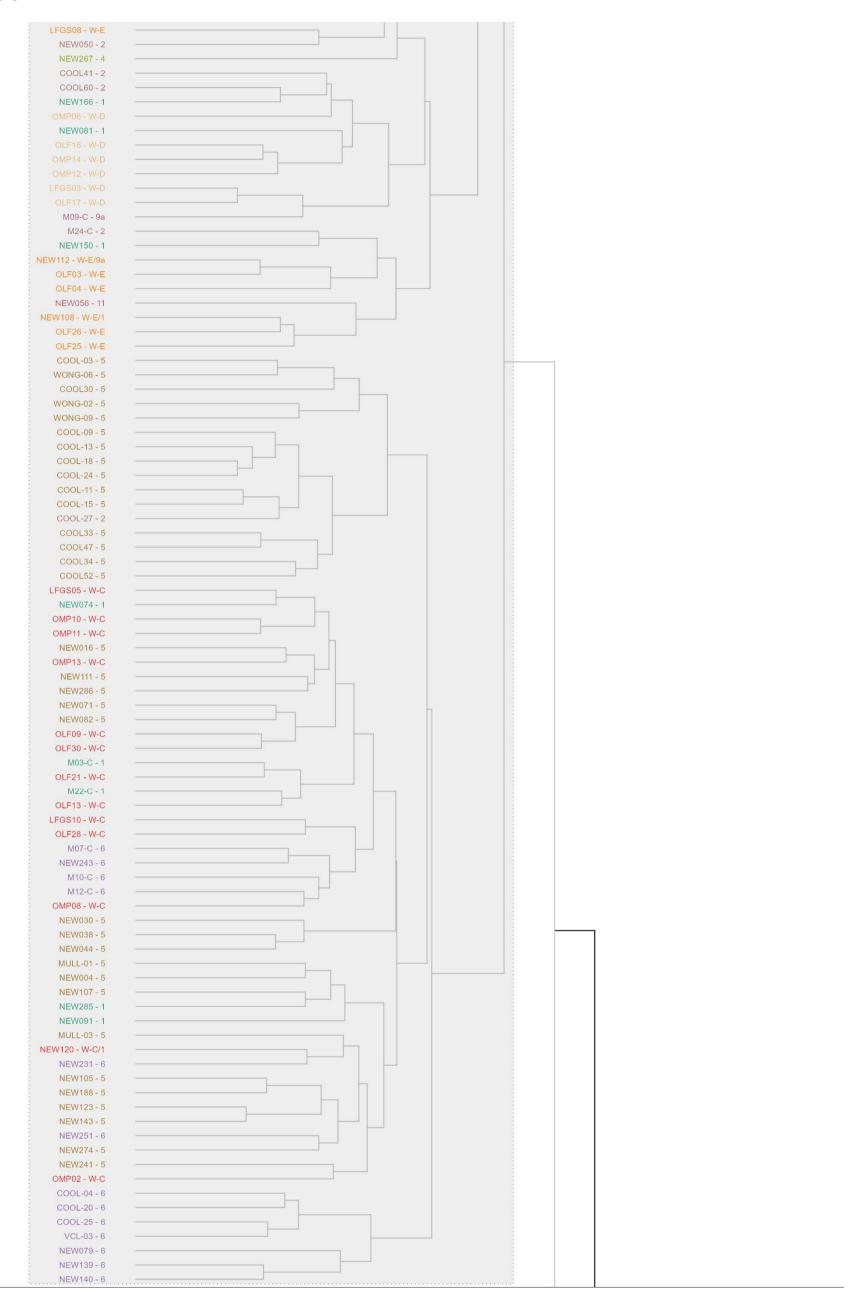


Agglomerative hierarchical clustering analysis dendrogram, including Cooljarloo West VTs for existing quadrats, and VT determinations from this current assessment (indicated after site name, and label colour-coded according to VT)

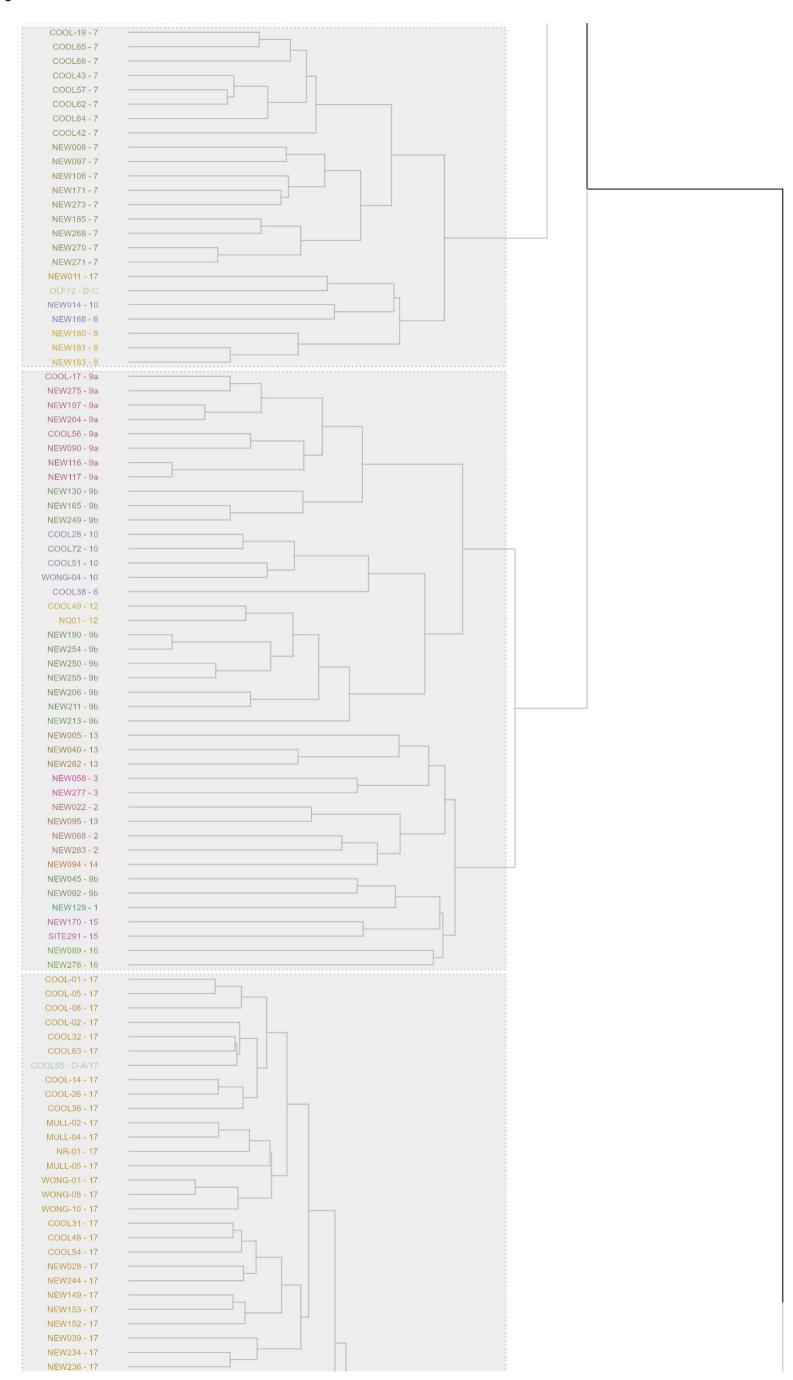




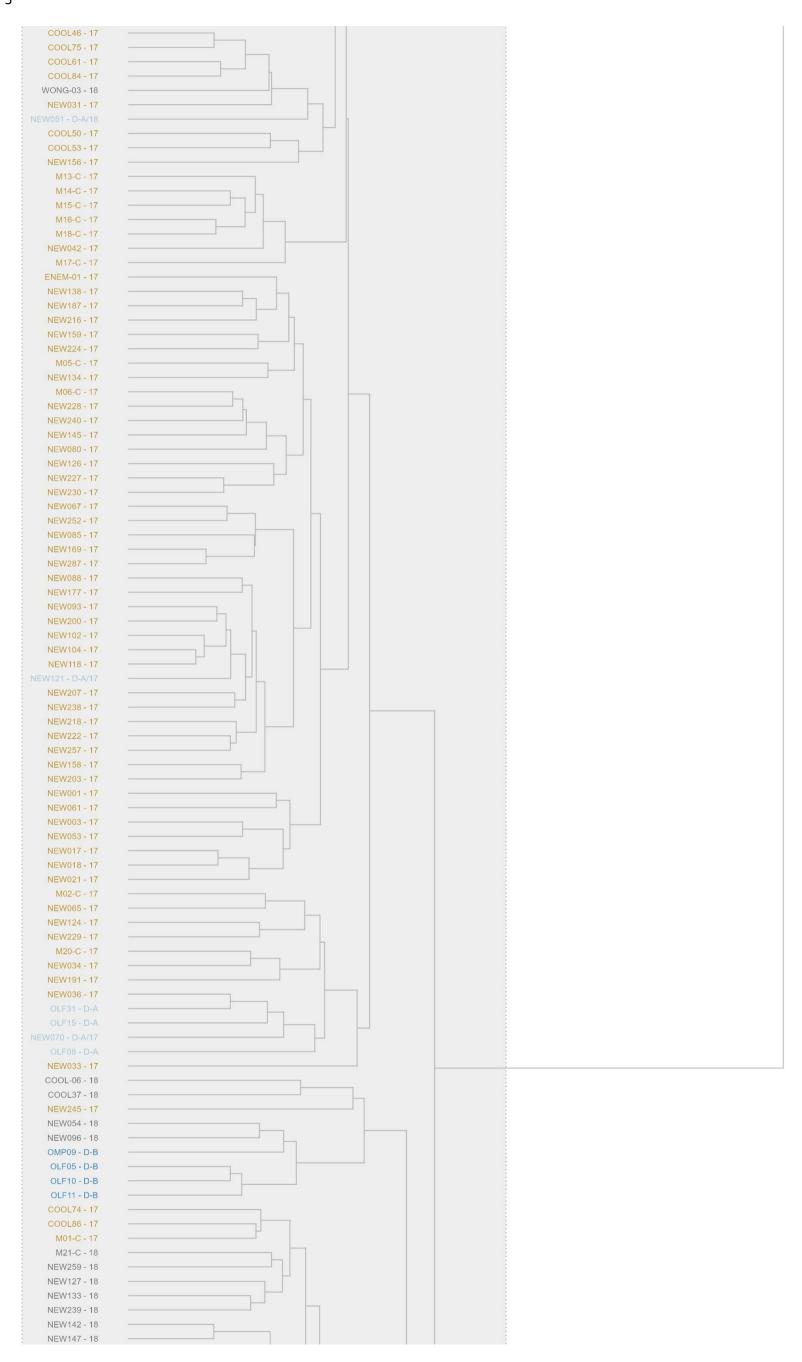




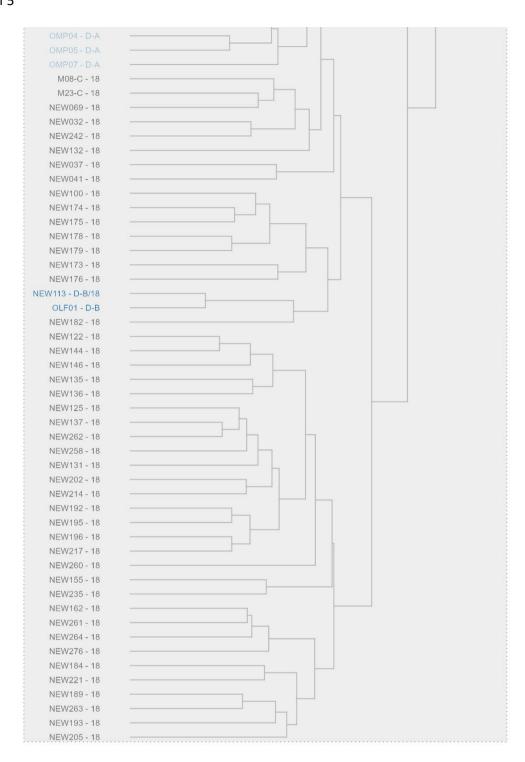
















Crite	rion	Description
Locatio	n and Ph	ysical Environment (must satisfy criterion 1)
1	L	Patch is located within the Swan Coastal Plain IBRA Bioregion
Soils an	d Landfo	orm (must satisfy criterion 2(a) OR 2(b))
2	(a)	Patch occurs on well-drained, low nutrient soils on sandplain landforms OR
	(b)	Patch occurs on sandy colluvium and aeolian sands of the Dandaragan Plateau
Structu	re and V	egetation (must satisfy criteria 3(a) AND 3(b), sometimes also satisfying criteria 3(c) and 3(d))
3	(a)	Is a low woodland to forest AND
	(b)	Patch includes at least one of the following Banksia species as dominant or co-dominant in the upper layer: • Banksia attenuata • Banksia menziesii • Banksia prionotes
	(c)	Banksia ilicifolia Patch includes emergent trees of medium or tall (> 10 m) height above the Banksia canopy, often including: Out to be the second of
		 Corymbia calophylla Eucalyptus marginata Eucalyptus gomphocephala Nuytsia floribunda Allocasuarina fraseriana Callitris arenaria
		Callitris pyramidalisXylomelum occidentale
	(d)	 Patch has an often highly species-rich understorey that consists of: a layer of sclerophyllous shrubs of various heights a herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses
Vegeta	tion Con	dition (must satisfy criterion 4(a) OR 4(b))
4	(a)	Vegetation condition of patch is Pristine to Good using the following indicative measures: • Low native species diversity to native species diversity fully retained • 0 % to 50 % weed cover OR
	(b)	Vegetation condition of patch is Degraded to Very Degraded but retains important natural values
Patch S	ize (mus	t satisfy criterion 5(a) OR 5(b))
5	(a)	Patch size meets the minimum size according to its condition, as below: Pristine – no minimum patch size applies Excellent – 0.5 ha or 5,000 m² (e.g. 50 m x 100 m) Very Good – 1 ha or 10,000 m² (e.g. 100 m x 100 m) Good – 2 ha or 20,000 m² (e.g. 200 m x 100 m) OR
	(b)	Patch is smaller than the above requirements but contributes to the overall function of the ecological community (e.g. contributes ß-diversity and connectivity)

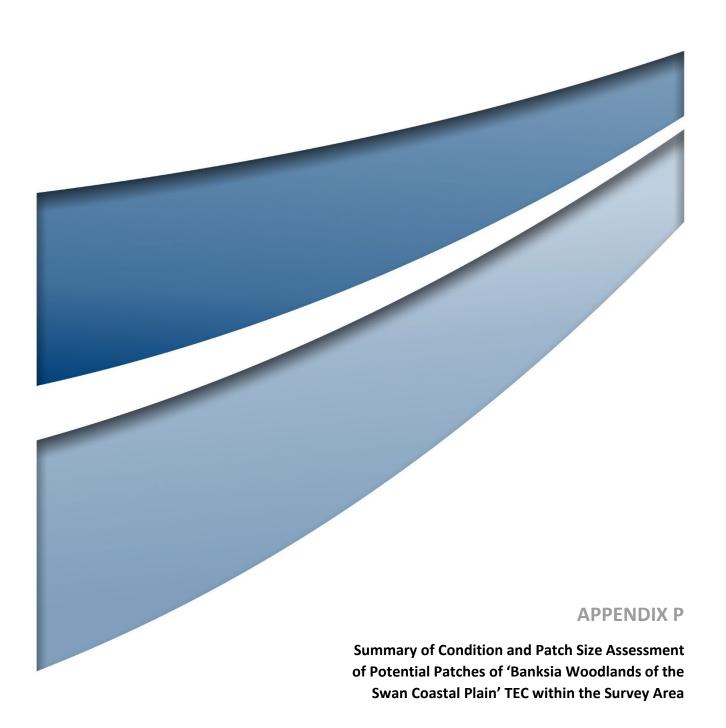


Contra-indicators	Description
1	Patch is clearly dominated by Banksia littoralis (indicates a different, dampland community)
2	Patch is clearly dominated by <i>Bankia burdettii</i> (indicates a tall shrubland and not the Banksia Woodlands ecological community)
3	Patch represents FCT 20c (corresponds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

Key

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

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





Potential	Potential		oped (ha)		Criteria Outcome		Other Considerations	Overall
Patch Number	Excellent	Very Good	Good	Total	Vegetation Condition*	Patch Size^		Outcome
1	0.14	-	1	0.14	Met	Not Met	Contributes to the overall function of the ecological community – contiguous vegetation occurs outside the Survey Area to the northeast, and if mapped, would meet the patch size requirements	Part of the TEC
2	0.46	-	1	0.46	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity	Not part of the TEC
3	0.15	-	1	0.15	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 4 is not within 30 m	Not part of the TEC
4	0.21	-	-	0.21	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 3 is not within 30 m	Not part of the TEC
5	0.39	-	-	0.39	Met	Not Met	Contributes to the overall function of the ecological community – contiguous vegetation occurs outside the Survey Area to the northeast, and if mapped, would meet the patch size requirements	Part of the TEC
6	0.42	-	-	0.42	Met	Not Met	Contributes to the overall function of the ecological community – contiguous vegetation occurs outside the Survey Area to the northeast, and if mapped, would meet the patch size requirements	Part of the TEC
7	68.75	-	-	68.75	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
8	0.32	-	-	0.32	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 9 is not within 30 m	Not part of the TEC
9	0.11	-	-	0.11	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 8 is not within 30 m	Not part of the TEC
10	0.09	-	-	0.09	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 11 is not within 30 m	Not part of the TEC



Potential	Potential Are		oped (ha)		Criteria Outcome		Other Considerations	Overall
Patch Number	Excellent	Very Good	Good	Total	Vegetation Condition*	Patch Size^		Outcome
11	0.10	-	ı	0.10	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patches 10 and 12 are not within 30 m	Not part of the TEC
12	25.02	-	-	25.02	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
13	0.29	-	1	0.29	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 14 is not within 30 m	Not part of the TEC
14	0.14	-	1	0.14	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 13 is not within 30 m	Not part of the TEC
15	0.10	-	-	0.10	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity	Not part of the TEC
16	0.11	-	-	0.11	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity	Not part of the TEC
17	0.12	-	-	0.12	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity	Not part of the TEC
18	1.14	-	-	1.14	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
19	0.15	-	-	0.15	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patches 12 and 20 are not within 30 m	Not part of the TEC
20	4.98	-	-	4.98	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC



Potential		Area Mapped (ha) Criteria C		Area Mapped (ha) Criteria Outcome Other Considerations		Other Considerations	Overall	
Patch Number	Excellent	Very Good	Good	Total	Vegetation Condition*	Patch Size^		Outcome
21	0.15	-	-	0.15	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patches 20 and 22 are not within 30 m	Not part of the TEC
22	7.43	-	-	7.43	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
23	0.24	-	-	0.24	Met	Not Met	Does not contribute significantly to the overall function of the ecological community – small island of vegetation that does not contribute to connectivity, potential patch 12 is not within 30 m	Not part of the TEC
24	0.92	-	-	0.92	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
25	1.41	-	-	1.41	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
26	96.67	2.36	0.03	99.06	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
27	128.69	5.18	0.84	134.72	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
28	0.60	-	-	0.60	Met	Met	Not required to be assessed; patch meets vegetation condition and patch size requirements	Part of the TEC
Total	339.30	7.54	0.87	347.71				

^{*} Criteria 4(a) and (b) of the key diagnostic characteristics (Appendix O).

[^] Criteria 5(a) and (b) of the key diagnostic characteristics (**Appendix 0**).



