Detailed Flora and Vegetation Survey of Sand Patch Meteorological Mast, Albany

Prepared for SynergyRED

Ref: *T22024*

ecological assessment
& management

Document Control

Revision	Details	Date	Author	Reviewer
Rev A	Draft for Internal Review	16/03/2023	V.Yeomans	J.Grehan
Rev 0	Draft for Submission to Client	17/03/2023	V.Yeomans	E.Jones
Rev 1	Revision for Submission to Client	28/03/2023	V.Yeomans	

Joseph Grehan

Principal Ecologist

DISCLAIMER

ABN 48 159 606 005

24 Railway Parade, Midland WA 6056

Telephone: (08) 9250 1163 / Mobile: 0400 003 688

Email: joeg@terratree.com.au

Website: www.terratree.com.au

Abbreviations and Acronyms

ARVS	Albany Regional Vegetation Survey
BAM Act	Biosecurity and Agriculture Management Act 2007
BC Act	Biodiversity Conservation Act 2016
BoM	Bureau of Meteorology
CALM	former Department of Conservation and Land Management (now DBCA), WA Government
DAWE	Department of Agriculture, Water and the Environment, Australian Government
DBCA	Department of Biodiversity, Conservation and Attractions, WA Government
DCCEEW	Department of Climate Change, Energy, and the Environment and Water
DEC	former Department of Environment and Conservation (now DBCA), WA Government
DEE	former Department of the Environment and Energy, Australian Government (now DAWE)
DMIRS	Department of Mines, Industry Regulation and Safety, WA Government
DPIRD	Department of Primary Industries and Regional Development, WA Government
DWER	Department of Water and Environmental Regulation, WA Government
EPA	Environmental Protection Authority, WA Government
EPBC Act	Environment and Protection and Biodiversity Conservation Act 1999
EP Act	Environment Protection Act 1986
ESA	Environmentally Sensitive Area
EWSWA	Environmental Weed Strategy for Western Australia
GDA94	Geocentric Datum Australia 1994
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
IUCN	International Union for the Conservation of Nature
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community

PMST	Protected Matters Search Tool
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora Database
UCL	Unallocated Crown Land
WAHERB	WA Herbarium Specimen Database
WALGA	Western Australian Local Government Authority

This page has been left blank intentionally.

Executive Summary

SynergyRED commissioned Terratree Pty Ltd (Terratree) to undertake a Detailed Flora and Vegetation survey for a proposed Meteorological Mast south of the western terminus of Sand Patch Road, Albany. The objective of the survey was to detect any flora and/or vegetation of conservation significance within the defined Project Area. The proposed Meteorological Mast (hereafter referred to as the 'project area') is located approximately 9 kilometers (km) southwest of Albany and the project area is 27.379 hectares (ha).

The Detailed Flora and Vegetation Survey was conducted between the 11th and 15th of October 2022. The quadrat-based survey entailed a single, primary (Phase 1) survey of a Detailed Flora and Vegetation Survey. Traverses were used to delineate the boundaries of significant flora populations within the Project Area when Priority or Threatened Flora were *readily identifiable in the field* at the time of the primary (Phase 1) survey by track logging and collecting waypoints using hand-held GPS units in systematic traversing of the Project Area.

A total of 163 species of Flora from 111 Plant Genera and 48 Plant Families were recorded within the 15 Quadrats for the Project Area. Of these, 40 taxa (24%) were from single collections across the quadrats and another 57 taxa (34%) were only recorded from opportunistic collections (outside the quadrats). This reflects the high diversity of herbs/ephemeral forbs and the mosaicking of vegetation units. Twenty-five of the opportunistic species were introduced weed species recorded along Sand Patch Road and/or the central firebreak track.

Opportunistic collections were used to compile a complete a species list as possible where the patchiness and diversity of herbs/ephemeral forbs and the mosaicking of vegetation units could not be adequately captured in quadrats alone. The practice of opportunistic collecting, the defined vegetation associations and recorded species richness is consistent with other vegetation surveys of the Wind Farm area and Environmental Protection Authority technical guidance.

There were 5 vegetation associations recorded, with one of these vegetation associations covering more than 40% of the Project Area, a Low Peppermint Forest/Coastal Heath Mosaic. The vegetation was mapped as a mosaic unit due to the rapid patterning of changes in form and species composition that cannot be differentiated at a meaningful scale. Areas of discrete pure vegetation units were mapped as Coastal Heath, Coastal Limestone Heath and Limestone Mallee. This vegetation patterning is consistent with the previous vegetation surveys of the Wind Farm area. The Limestone Mallee and Limestone Mallee/Coastal Limestone Heath Mosaic of the Project Area is not represented in the ARVS, largely due to the limited relevés that were conducted in that study within this vegetation association.

Two Priority flora species were detected (2 individuals of *Adenanthos xcunninghamii* (P4) and ~300+ individuals across five populations of *Thomasia quercifolia* (P4)) during the Targeted flora survey traversing across the Project Area.

The recording of opportunistic additional flora species and targeted searches for conservation significant flora was undertaken along transects spaced up to ~50m apart to cover as much of the Project Area as possible and intersect all potential habitat types. Due to the density of the heath/mallee thickets/closed shrubland vegetation there was limited visibility from each transect line from which to detect additional/potentially occurring conservation significant flora species.

Of the 16 desktop identified conservation significant species with suitable habitat within the Project Area, two were detected (2 individuals of *Adenanthos xcunninghamii* (P4) and ~300+ individuals across five populations of *Thomasia quercifolia* (P4)), with the presence of the other identified species remaining possible to likely (*Calectasia cyanea* (T), *Pterostylis heberlei* (P2), *Caladenia evanescens* (P1), *Gyrostemon thesioides* (P2), *Corysanthes limpida* (P4), *Drosera fimbriata* (P4)) due to the dense heathland and lack of visibility across traverses of the primary survey.

If the proposed Meteorological Mast development is going to impact areas of the Project Area that were not comprehensively traversed in the primary survey, then infill Targeted flora searches would be recommended to determine any impact to conservation significant species for which the presence remains likely or possible. Due to project logistical difficulties, in many areas of the Project Area the spacing of systematic traversing was >50 m (in dense vegetation with limited visibility), more than the accepted width of 10 m for flora in the Southwest. Some orchids and smaller herbs are also likely to require more intensive searches (EPA 2016b). Additional individuals of *Adenanthos* x*cunninghamii* (P4) may occur in the Peppermint Low Forest/Coastal Heath Mosaic particularly the areas in recovery from fire, due to the difficulty of verifying young seedlings at the time of the primary survey.

Twenty-five of the opportunistic species recorded were introduced weed species located along Sand Patch Road and/or the central firebreak track. Additional weed density and distribution mapping may also be required to prevent the spread of weeds/ monitor changes to vegetation condition as part of the development proposal. One weed species in particular *Centranthus ?macrosiphon* is of interest to the WA Herbarium (will be submitted for further study) as it represents a potential new incursion of the *Centranthus* genus into Western Australia. The presence of this potential new weed species should be monitored for invasiveness.

Contents

Executive Summary vi

1 Introduction 1

1.1 Background 1

1.2 Project Size and Location 1

1.3 Scope of Work 1

2 Regulatory Context 2

2.1 Relevant Legislation and Guidance 2

2.1.1 Government Legislation 2

2.1.2 Government Regulatory Guidelines 2

2.2 Threatened and Priority Flora and Ecological Communities 2

2.2.1 Biodiversity Protection in Western Australia 2

2.2.2 Biodiversity Conservation Act 2016 2

2.2.3 Environment Protection and Biodiversity Conservation Act 1999 4

2.3 Environmentally Sensitive Areas 5

2.4 Introduced Flora (Weeds) 5

2.4.1 Impacts and Sources of Weeds 5

2.4.2 Declared Pest Plants 6

2.4.3 Environmental Weeds 7

2.4.4 Weeds of National Significance (WONS) 8

3 Existing Environment 9

3.1 Biogeography 9

3.2 Regional Vegetation 9

3.3 Soils and Landforms 11

3.4 Climate 11

4 Methods 12

4.1 Desktop Review Methods 12

4.1.1 Desktop Assessment 12
4.1.2 Previous Studies 12
4.2 Field Survey Strategy 13
4.3 Traverses 13
4.4 Quadrats 13
4.5 Opportunistic Sampling 14
4.6 Vegetation Structure 14
4.7 Taxonomy and Nomenclature 15
4.8 Statistical Analysis of Quadrat Similarity 15
4.9 Defining Vegetation Associations and Mapping 16
4.10 Describing Vegetation Condition 16
5 Results 19
5.1 Desktop Review Results 19
5.1.1 Threatened and Priority Flora 19
5.1.2 Threatened and Priority Ecological Communities 24
5.1.3 Environmentally Sensitive Areas 25
5.1.4 Introduced Flora 25
5.2 Field Survey Results 26
5.2.1 Flora Identified 26
5.2.2 Threatened and Priority Flora Recorded 26
5.2.3 Flora of Other Conservation Significance 30
5.2.4 Vegetation Associations 30
5.2.5 Threatened and Priority Ecological Communities 38
5.2.6 Species Diversity within Vegetation Associations 38
5.2.7 Vegetation Condition 40
5.2.8 Introduced Flora 40
5.3 Survey Limitations 42

6 Discussion 45

7 Conclusions and Recommendations 47

8 References 81

9 Figures 85

10 Appendices 99

List of Tables

Table 1: Legal status of organisms under the BAM Act (DPIRD 2023). 6

Table 2: Control categories for declared pests (DPIRD 2023). 7

Table 3: Criteria for Environmental Weeds Strategy rating (CALM 1999) 8

Table 4: Extant Vegetation within the Project Area 9

Table 5: Albany Regional Vegetation Survey Vegetation Units of the Windfarm Area. 10

Table 6: Previous environmental surveys of the Wind Farm Area 12

Table 7: Keighery vegetation disturbance scale and assessability (Keighery 1994, adapted from EPA 2016a). 18

Table 8: Threatened and Priority flora recorded within 20km radius of Project Area 19

Table 9: Priority and Threatened Ecological Communities recorded within 20km radius 25

Table 10: Introduced flora recorded within the City of Albany (2019) 25

Table 11: Vegetation Associations Mapped in the Project Area 32

Table 12: Summary of Vegetation Associations in the Project Area 38

Table 13: Area statement of Vegetation Condition Ratings in the Project Area 40

Table 14: Summary of introduced flora recorded in the Project Area 40

Table 15: Discussion of potential limitations to the survey (adapted from EPA 2016b) 43

List of Graphs

Graph 1: Rainfall data from Little Grove (#9766) and Temperature data from Albany (#9500) (BoM 2023). .. 11

List of Photos

Photo 1: *Adenanthos* x*cunninghamii* (P4) habit, within the Project Area 27

Photo 2: *Adenanthos* x*cunninghamii* (P4) closeup, within the Project Area 28

Photo 3: *Thomasia quercifolia* (P4) within the Project Area..... 29

Photo 4: *Thomasia quercifolia* (P4) closeup within the Project Area 29

Photo 5: Vegetation of the Project Area looking Northwest from -35.06818328, 117.80524393..... 31

Photo 6: Occasional orchid species, *Caladenia applanata* subsp. *applanata* 39

Photo 7: Orchid species (leaves only/unburnt area), within 'Peppermint Low Forest/Coastal Heath Mosaic' 39

Photo 8: *Centranthus ?macrosiphon* recorded along Sand Patch Road 42

List of Figures

Figure 1: Project Location map 85

Figure 2: Extant Vegetation..... 87

Figure 3: DBCA Recorded Flora Locations..... 89

Figure 4: Survey Effort Quadrats and Flora Traverses 91

Figure 5: Priority Species Density Map 93

Figure 6: Vegetation Associations..... 95

Figure 7: Vegetation Condition 97

List of Appendices

Appendix A: Conservation Codes under WA and Commonwealth Legislation..... 99

Appendix B: NVIS Structural Formation Terminology (NVIS TWG 2017)..... 106

Appendix C: EPBC Protected Matters Search Results..... 107

Appendix D: Species List from the Detailed Flora and Vegetation Survey 2022 142

Appendix E: Quadrat Data and Vegetation Descriptions..... 149

Appendix F: Species by Site Matrix 180

Appendix G: PATN Floristic Analysis and Species Accumulation Curve 184

1 Introduction

1.1 Background

SynergyRED commissioned Terratree Pty Ltd (Terratree) to undertake a Detailed Flora and Vegetation survey for a proposed Meteorological Mast. The objective of the survey was to detect any flora and/or vegetation of conservation significance within the defined Project Area, with the scope of work detailed in Section **1.3**.

1.2 Project Size and Location

The proposed Meteorological Mast (hereafter referred to as the 'project area') is located approximately 9 kilometers (km) southwest of Albany (**Figure 1**). The Project Area is **27.379 hectares (ha)** in total area.

1.3 Scope of Work

The scope of work for the project included the following:

- Conduct a desktop assessment to determine the broad environmental values of the Project Area and surrounds and to identify Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), Threatened or Priority Flora species that could potentially occur within the Project Area.
- Undertake a 'Phase 1' Detailed Flora and Vegetation field survey of the Project Area within the primary survey period for the Warren subregion.
- Undertake Targeted Survey of conservation significant flora (of those *readily identifiable in the field*), with systematic appropriately spaced transects to provide density and extent, population data.
- Produce an inventory of the flora and vegetation communities present and
- Produce figures showing the location of any TECs, PECs or Threatened or Priority Flora if present.
- Produce figures showing the extent of the vegetation associations defined for the Project Area.
- Produce figures showing the extent of any variation in vegetation condition observed.
- Prepare a comprehensive technical report detailing the results of the desktop assessment, field survey and all associated spatial data.
- Make management recommendations to avoid in the first instance, and, if unavoidable minimise and mitigate impacts to significant conservation values.

2 Regulatory Context

2.1 Relevant Legislation and Guidance

2.1.1 Government Legislation

The following legislation applies to flora, vegetation and the protection of biodiversity in Western Australia:

- *Biodiversity Conservation Act 2016 (BC Act)* (WA)
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) (WA)
- *Environmental Protection Act 1986* (EP Act) (WA)
- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth).

2.1.2 Government Regulatory Guidelines

The following regulatory guidelines apply to flora, vegetation and the protection of biodiversity in Western Australia:

- Environmental Factor Guideline – Flora and Vegetation (EPA 2016a)
- Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual (EPA 2020)
- Environmental Protection (Clearing of Native Vegetation) Regulation 2004
- Environmental Protection (Environmentally Sensitive Areas) Notice 2005
- Guidance Statement No. 33 – Environmental Guidance for Planning and Development (EPA 2008)
- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)

2.2 Threatened and Priority Flora and Ecological Communities

2.2.1 Biodiversity Protection in Western Australia

Biodiversity in Western Australia is protected, managed and assessed under international, national and state agreements, legislation and policy. For Environmental Impact Assessment, the Commonwealth *Environment* EPBC Act and the Western Australian BC Act are of relevance to WA flora, fauna and ecological communities.

2.2.2 Biodiversity Conservation Act 2016

At the State level, the BC Act provides protection for any native plant or animal species that is indigenous to Western Australia. Any activity in Western Australia that involves taking part of or the whole of a WA native plant or animal (including damage caused by human activities) may require a license or permit to do so.

Under the BC Act, flora and fauna that have been adequately searched for and are deemed to be either rare or in danger of extinction are gazetted as Threatened species. Specially Protected species (e.g. migratory animals) in need of special protection in the wild are provided with a separate categorisation under the Act. A third category exists for species considered to be Extinct.

The Threatened Species Scientific Committee provides advice to the Minister for Environment on the listing of flora and fauna species to be protected under the BC Act. Threatened species are categorised according to their level of threat using International Union for the Conservation of Nature (IUCN) Red List criteria:

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

At the State level, the term 'Threatened' is commonly used to refer to all species under the classification of Threatened, regardless of their Commonwealth status.

Ecological communities are naturally occurring groups of plant, animals and other organisms that interact within a unique habitat. Under the BC Act, TECs are now protected through a statutory listing. The Threatened Ecological Communities Scientific Committee provides advice to the Minister for Environment on the listing of ecological communities to be protected under the BC Act. TECs are categorised according to their level of threat:

- Critically Endangered
- Endangered
- Vulnerable
- Presumed Totally Destroyed.

Annually, a government gazette listing current Threatened and Extinct species under the BC Act is issued by the Western Australian Government and listed on the DBCA website. These taxa are legally protected and their removal, or impact to their surroundings, cannot be conducted without Ministerial approval, obtained specifically on each occasion for each population. As the BC Act is transitioning from the *Wildlife Conservation Act* 1950, the current lists are scheduled under the previous legislation and contain only flora and fauna species, not ecological communities. However, the current list of TECs has been endorsed by the Minister of Environment.

DBCA maintains lists of Priority flora and fauna species and ecological communities (DBCA 2019). These are taxa that are considered poorly known, uncommon or under threat but for which there is insufficient justification, based on known distribution and population sizes, for inclusion as Threatened species or TECs under the BC Act. The categories for Priority species and ecological communities give an indication of the priority for undertaking further surveys based on the number of known sites and degree of threat to those populations.

The DBCA lists are reviewed annually and published on their website, and include all Threatened, Extinct and Priority species and Threatened and Priority ecological communities in WA. DBCA enforces regulations under

the BC Act to conserve all Threatened and Priority flora, fauna and ecological communities in WA and protect significant populations.

Conservation codes used for WA flora, fauna and ecological communities are provided in **Appendix A** (**Tables A.1** and **A.2).**

2.2.3 Environment Protection and Biodiversity Conservation Act 1999

At a Commonwealth level, threatened flora, fauna and ecological communities are protected under the EPBC Act. The species and ecological communities protected at the State level may be different to those protected at the Commonwealth Level (and vice versa). It is therefore important to confirm their status at both State and Commonwealth levels.

Under the provisions of the EPBC Act, proposed actions that potentially have a significant impact on a matter of national environmental significance must be referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and potentially for the approval of the Commonwealth Minister for the Environment, for a decision as to whether an assessment is required under the provisions of the Act. The matters of national environmental significance are:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act categorises Threatened species are according to their level of threat:

- Extinct
- Extinct in the wild
- Critically endangered
- Endangered
- Vulnerable
- Conservation Dependent.

Threatened Ecological Communities are protected under the following categories under the EPBC Act:

- Critically Endangered
- Endangered
- Vulnerable.

Conservation codes used for Australian flora and TECs protected under the EPBC Act are provided in **Appendix A** (**Tables A.3** and **A.4**).

2.3 Environmentally Sensitive Areas

Under the EP Act, it is an offence to clear native vegetation without a permit or unless an exemption applies. The *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* declares Environmentally Sensitive Areas (ESAs) to include:

- Defined wetlands and riparian vegetation within 50 m of these
- Areas covered by TECs
- Areas of vegetation within 50 m of rare flora
- Bush Forever sites (DEP 2000)
- Declared World Heritage property sites
- Areas included on the Register of the National Estate because of their natural heritage values.

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, exemptions for low impact routine and management practices do not apply to ESAs and a clearing permit is required.

2.4 Introduced Flora (Weeds)

2.4.1 Impacts and Sources of Weeds

When introduced flora (weeds) are established in an existing native vegetation complex, ecological and landscape values can be negatively impacted. Impacts from weeds include, but are not limited to:

- competition with native flora for light, water, space and nutrients
- introduction of associated plant pathogens and pests
- reduced floristic diversity
- altered vegetation structure
- increased risk of soil erosion in some instances
- altered fire regimes.

Weeds can be introduced into existing vegetation complexes by a variety of vectors, both natural and human influenced. Several of these, including wind, surface water and fauna, are naturally occurring processes. Human activities and influences which can introduce exotic flora species into an area include, but are not limited to:

- wheels and machinery, digging/drilling components, etc. that contain plant material or seeds
- altered surface water flow
- introduction of exotic fauna
- disturbance to vegetation and soil.

2.4.2 Declared Pest Plants

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) seeks to prevent serious animal and plant pests and diseases from entering Western Australia and becoming established, and to minimise the spread and impact of any that are already present. The Minister for Agriculture can categorise an organism as a declared pest under the BAM Act if:

- it has or may have an adverse effect on another organism in the area; or human beings in the area; or the environment, or part of the environment, in the area; or agricultural activities, fishing or pearling activities, or related commercial activities, carried on, or intended to be carried on, in the area
- it may have an adverse effect on any of those things if it were present in the area, or if it were present in the area in greater numbers or to a greater extent.

The Western Australian Organism List lists organisms and their legal status in Western Australia under the BAM Act (DPIRD 2023) (Table 1).

Table 1: Legal status of organisms under the BAM Act (DPIRD 2023).

Status	Description
Declared Pest, Prohibited - s12	Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest - s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia.
Permitted - s11	Permitted organisms must satisfy any applicable import requirements when imported. They may be subject to an import permit if they are potential carriers of high-risk organisms.
Permitted, Requires Permit - r73	Regulation 73 permitted organisms may only be imported subject to an import permit. These organisms may be subject to restriction under legislation other than the Biosecurity and Agriculture Management Act 2007. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.

Status	Description
Unlisted - s14	If you are considering importing an unlisted organism/s, you will need to submit the name/s for assessment, as unlisted organisms are automatically prohibited

The *Biosecurity and Agriculture Management Regulations 2013* categorises declared pests into four control categories (DPIRD 2023) (Table 2).

Table 2: Control categories for declared pests (DPIRD 2023).

Declared Plant Category	Description
C1 - Exclusion	Organisms which should be excluded from part or all of Western Australia.
C2 - Eradication	Organisms which should be eradicated from part or all of Western Australia.
C3 - Management	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.

Under the BAM Act, a local government can also declare a plant to be a 'pest plant', so long as it is not already a declared plant under the Act. These plants are gazetted under a local government's local laws and allow control to be enforced on any private land within a local government's boundaries. A local law can be made for the purpose of:

"prescribing as a pest plant in that district any plant (other than a declared pest for that area) that, in its opinion, is likely to adversely affect the environment of the district, the value of property in the district or the health, comfort or convenience of the inhabitants of the district" (BAM Act).

2.4.3 Environmental Weeds

The State of the Environment Report (EPA 2007) states that Western Australia has over 1200 recognised weed species. The Environmental Weed Strategy for Western Australia (EWSWA; CALM 1999) rated all weeds known in Western Australia at the time of publication according to their invasiveness, distribution and environmental impacts (Table 3). The weeds were classified into four categories: High, Moderate, Mild and Low. High-rated species are those that all three criteria apply to, and Moderate-rated species are those where only two of the criteria apply. The EWSWA assessed 1,350 weed species recorded in Western Australia, with 34 weed species classified as High.

Table 3: Criteria for Environmental Weeds Strategy rating (CALM 1999)

Criteria	Description
Invasiveness	Ability to invade bushland in good to excellent condition or ability to invade waterways.
Distribution	Wide current or potential distribution including consideration of known history of widespread distribution elsewhere in the world.
Environmental Impacts	Ability to change the structure, composition, and function of ecosystems. In particular, an ability to form a monoculture in a vegetation community.

2.4.4 Weeds of National Significance (WONS)

At a national level, there are 32 weed species listed as Weeds of National Significance (WONS) (DAWE 2021). These are plants that have been selected for their invasiveness and impact characteristics, potential and current area of spread and their primary industry, environmental and socioeconomic impacts. The Australian Weeds Strategy 2017–2027 (IPAC 2017) describes the broad goals and objectives in managing weeds in Australia, including WONS species. Many Weeds of National Significance are also declared pests under the BAM Act in WA.

3 Existing Environment

3.1 Biogeography

The Interim Biogeographic Regionalisation for Australia (IBRA) has defined 89 bioregions and 419 subregions across Australia, based on climate, geology, landforms, native vegetation and species (DCCEEW 2021). These provide a useful method for reporting biodiversity patterns and categorising survey areas. The Project Area is located within the South-west Forest Region (Darling Botanical District) and the Warren (WAR01) subregion.

A biodiversity audit of Western Australia's subregions classifies the Warren subregion as follows:

- "Dissected undulating country of the Leeuwin Complex, Southern Perth Basin (Blackwood Plateau), South-West intrusions of the Yilgarn Craton and western parts of the Albany Orogen with loamy soils supporting Karri forest, laterites supporting Jarrah-Marri forest, leached sandy soils in depressions and plains supporting low Jarrah woodlands and paperbark/sedge swamps, and Holocene marine dunes with *Agonis flexuosa* and *Banksia woodlands* and heaths. The climate is moderate Mediterranean. The bioregion is not further divided into subregions and the area is 1, 027, 639ha (Hearn *et al.* 2002)."

Dominant land uses in the Warren IBRA subregion are grazing, cultivation, forestry, conservation, rural residential, mining and easements (Hearn *et al.* 2002).

3.2 Regional Vegetation

Regional vegetation type and extent is based on regional scale mapping by Beard (1979), compiled by Shepard *et al.* (2002). The post clearing reservation status is listed by WALGA (2020) in **Table 4.**

One Vegetation Association occurs within the Project Area, namely '*Torndirrup 49 – Shrublands; mixed heath'.* It is estimated that 97.39% remains of the Vegetation Association within the Warren IBRA subregion (WALGA, 2020).

Table 4: Extant Vegetation within the Project Area

Vegetation Association	Pre-European extent (ha)	Current extent (ha)	% Remaining
Torndirrup System 49	9, 696.96	9,443.73	97.39

The Albany Regional Vegetation Survey (ARVS) (Sandiford and Barrett, 2010) mapped the vicinity of the Project Area as a mosaic of vegetation units, Peppermint Low Forest (2), Coastal Heath (3), Coastal Limestone Heath (5) and Limestone Mallee (6) as listed in **Table 5.**

The coastal dune system is part of the Meerup Landform Unit (Churchward *et al.,* 1988). Higher areas contained a mosaic of Limestone Heath (5), Coastal Heath (3) Peppermint Low Forest (2), and less commonly *Eucalyptus goniantha/E. angulosa* Mallee (6) with distribution of units appearing to be dependent upon soil pH and soil depth. Inland and downslope *Banksia ilicifolia*/Peppermint Woodland (5) occurred as a band interspersed with these units. On the lower and more protected slopes and flats overlying limestone pavements Coastal Yate Woodland (1), Peppermint Low Forest (2) and less commonly Coastal Heath (4) and Limestone Heath (5) formed mosaics (ARVS, Sandiford and Barrett, 2010).

Peppermint Low Forest (2) is restricted to the coastal dune system where it commonly occurs in swales and flats and is common along the southwest coastline. The current extent was estimated at 1232 ha, of which 73% is reserved in either IUCN I-IV or other crown reserves. This vegetation unit forms a mosaic with Coastal Heath (3), Coastal Limestone Heath (5), Coastal *Banksia ilicifolia*/Peppermint Low Woodland (4) and Coastal Yate Woodland (1) (ARVS, Sandiford and Barrett, 2010). Coastal Heath (3) is restricted to light grey sand on the coastal dune system with extensive areas occurring from Torndirrup National Park west to Torbay Inlet. The current extent was estimated at 3737ha, of which 86.2% is reserved in either IUCN I-IV or other crown reserves (ARVS 2010). Coastal Limestone Heath (5) is described as a heterogenous group that is restricted to limestone soils and yellow-grey and light grey alkaline sands of the coastal fringe. The current extent was estimated at 1849 ha, of which 82.3% is reserved in either IUCN I-IV or other crown reserves (ARVS, Sandiford and Barrett, 2010). Limestone Mallee is found on moderate to steep limestone outcrops along the coastal dune system in a mosaic with Coastal Heath (3) and Coastal Limestone Heath (5) with which it shares many species. There was only 29 ha of this vegetation unit mapped within reserves of the ARVS (Sandiford and Barrett, 2010).

Table 5: Albany Regional Vegetation Survey Vegetation Units of the Windfarm Area.

ARVS Vegetation Unit	Current extent (ha)	% Reserved
Peppermint Low Forest (2)	1232	73
Coastal Heath (3)	3737	86.2
Coastal Limestone Heath (5)	1849	82.3
Limestone Mallee (6)	29ha	100

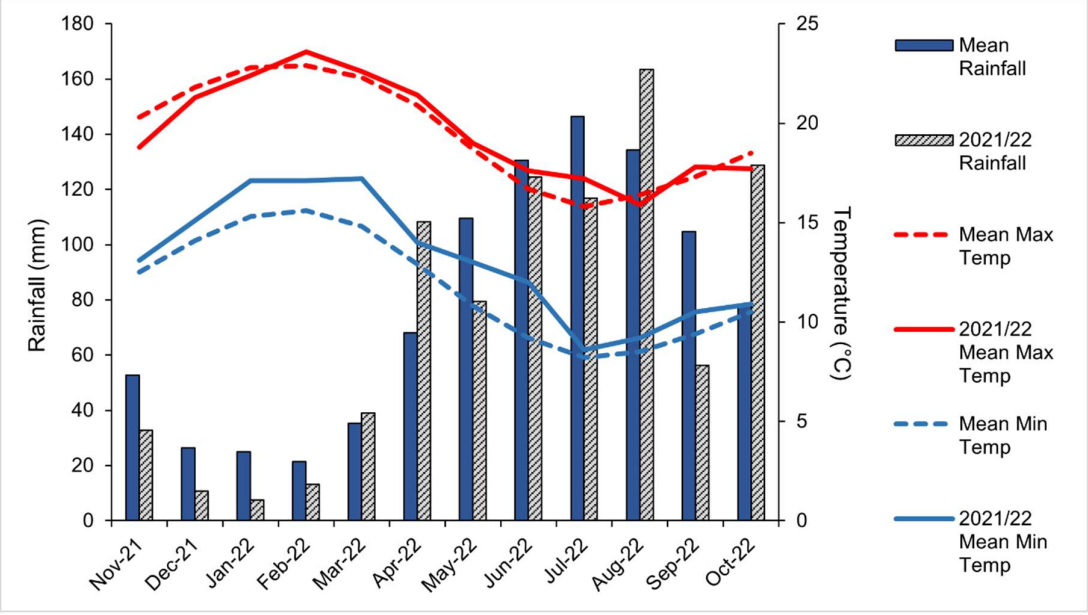
3.3 Soils and Landforms

The Department of Primary Industries and Regional Development (DPIRD 2018) soil-landscape mapping shows the Project Area is part of the south coast and hinterland, where the soil is mapped as: 'Calcareous sand with shallow leaching; peppermint woodland'. This is part of the original Meerup Coastal Aeolian Landform Unit (Churchward *et al.* 1988).

3.4 Climate

The Warren IBRA subregion is described as a having a moderate Mediterranean type climate (Hearn *et al.* 2022). It occurs within the high rainfall zone of the South-west Forest Region (Hopper 1979).

Based on rainfall data from Little Grove (Station #9766 rainfall data 1969 to present), approximately 7.5 km east of the Project Area, the local area receives on average 933.2 mm of rainfall per year with most rainfall falling in the winter months of June, July and August. A total of 336 mm of rain fell in the three months preceding the survey (July to September) which is 49 mm less than the average of 385 mm for the same period (BoM 2023). Monthly mean temperatures maximum and minimum were above average over 2022.



Graph 1: Rainfall data from Little Grove (#9766) and Temperature data from Albany (#9500) (BoM 2023).

4 Methods

The Detailed Flora and Vegetation Survey was conducted between the 11th and 15th of October 2022. The survey effort was directed by Lead Botanist Vanessa Yeomans, along with Ecologist Jemma Marshall of Terratree and local Botanist Craig Luscombe of Nindethana. The survey consisted of a desktop assessment followed by a field survey, conducted in accordance with the Environmental Protection Authority's (EPA) *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) and applied in conjunction with the *Environmental Factor Guideline for Flora and Vegetation* (EPA 2016a).

4.1 Desktop Review Methods

4.1.1 Desktop Assessment

Prior to the field survey, a database search was undertaken to identify flora and ecological communities of conservation significance previously recorded within the Project Area and surrounds. The following databases were consulted:

- Protected Matters Search Tool (PMST) (DAWE 2022a)
- Threatened and Priority Flora (TPFL) (DBCA 2022a)
- WA Herbarium specimen (WAHERB) (DBCA 2022b)
- Index of Biodiversity Surveys for Assessments (IBSA) (DWER 2022).

4.1.2 Previous Studies

The findings of previous flora and vegetation surveys conducted within the general surrounds of the Project Area were reviewed. Relevant reports, that were able to be accessed, are listed in **Table 6**. The closest prior ecological survey to the Project Area is the survey of the 15 Wind Farm turbines by Eco logical in 2020.

Table 6: Previous environmental surveys of the Wind Farm Area

Author	Year	Reference
Eco Logical	2020	Flora and Vegetation Survey - Albany Wind Farm
Sandiford and Barrett (ARVS 2010)	2010	Albany Regional Vegetation Survey Extent type and Status

4.2 Field Survey Strategy

The Detailed Flora and Vegetation survey considers the optimal survey timing (primary) for the South-West as Spring (September-November) with supplementary survey recommended for secondary peaks in rainfall/flowering of additional suites of species (after Autumn rains) (EPA 2016b). All flora species within quadrats were collected, and other taxa within the vicinity of the quadrats were opportunistically sampled, over five days in mid Spring. The quadrat survey entailed a single primary (Phase 1) survey of a Detailed Survey "where adequate survey may necessitate multiple survey attempts in the same or different season" according to the EPA Technical Guide (EPA 2016b).

4.3 Traverses

Traverses were used to delineate the boundaries of significant flora populations within the Project Area when Priority or Threatened Flora were *readily identifiable in the field* at the time of the primary (Phase 1) survey by track logging and collecting waypoints using hand-held GPS units. The traverses were spaced as closely as possible at the time of the primary survey, in some areas >50 m wide spacing. The coverage of which was dictated by density of vegetation (ability to move through the thickets) and time constraints. The search width for traverses is determined by the distance over which a targeted species can reasonably be observed, considering the general vegetation structure/density within the search area and conspicuousness of the species being targeted. 'An effective width of 10 m is acceptable for many flora surveys in the Southwest, equating to a 5 m search area either side of the walked transect. Some orchids and smaller herbs are likely to require more intensive searches' (EPA. 2016b). A targeted survey requires one or more site visit/s by an experienced botanist to locate and record details of significant flora individuals and populations, and/or extent of vegetation. Surveys should be undertaken when the targeted flora and/or vegetation are most detectable and identifiable in the field (usually when in flower) (EPA. 2016b). The Traverses are shown in **Figure 4**.

4.4 Quadrats

A total of 15 quadrats were sampled within the Project Area which are presented spatially in **Figure 3**. Quadrat locations were selected using aerial photography, topographic features and field observations to represent the diversity of vegetation present. All quadrats sampled were 100 sqm in size, using quadrat dimensions of 10 m x 10 m or equivalent. Standardised digital data collection sheets were used to ensure consistent data records for the following features in each quadrat:

- Observer
- Date
- Location/Site
- GPS Location (GDA 94)
- Species observed;
- Height of all species present
- Percentage foliage cover (to determine dominance)
- Soil type and colour
- Degree and nature of disturbance
- Vegetation community and condition
- All flora species within quadrats were collected, and other taxa within the vicinity of the quadrats were opportunistically sampled.

4.5 Opportunistic Sampling

Opportunistic sampling was undertaken outside quadrats during vegetation mapping and Targeted flora traverses throughout the Project Area, where time and accessibility permitted, to provide as complete a floristic species inventory as possible.

4.6 Vegetation Structure

Floristic Communities defined within Quadrats and Relevés are described using the National Vegetation Information System (NVIS) structural formation terminology in accordance with the Australian Vegetation Attribute Manual (NVIS TWG 2017) (**Appendix B**). The NVIS Information Hierarchy is based firstly on structural information and secondly on dominant genus and growth form collected at the sub-stratum level. Standardised descriptions provide the basis for comparing vegetation types between datasets with disparate mapping methods and hence identifying equivalent vegetation types. For the mapping of vegetation types across the Project Area, the final groupings (See Section **3.8** and **3.9**) are described using a minimum of Vegetation Association Level V as prescribed by the EPA Guidance Statement (EPA 2016b).

The description of Association is defined for the NVIS. At this level, the 3 traditional strata (i.e. Upper, Mid, Ground) (McDonald *et al*., 1990), are recognised where appropriate. For each stratum, the characteristic height (tall/mid /low) and cover (closed/open/sparse) are recorded; also, up to 3 growth forms and up to 3 species (dominant and/or diagnostic) can be used to describe the vegetation type at Level V. (Growth form, cover and height are implied as per Table 4in Section 2 of the Australian Vegetation Attribute Manual, (NVIS TWG 2017) **Appendix B**).

4.7 Taxonomy and Nomenclature

For future reference, verification and evidence, specimens of all taxa encountered in the Detailed Survey, were collected, labelled, pressed, dried and frozen in accordance with the requirements of the WA Herbarium. Subsequently, their identification was confirmed by Lead Botanist Vanessa Yeomans and/or Shibi Chandran by comparing collections with pressed specimens housed at the herbarium and using taxonomic keys and other reference materials.

Further specialist taxonomic treatment was sought as required using the services of the WA Herbarium. Species names used in this report are those adopted by the WA Herbarium and they have been checked against current FloraBase records (WA Herbarium, 2023). Specimens that could not be positively identified due to inadequate material are denoted with a ? or 'sp.' or aff. Phrase Names and their Author are used for taxa that do not yet have published formal names according to the WA Herbarium. Species lists can include 'sp.' (species), subspecies as subsp., varieties as var. and manuscript names as 'ms' or species complex/'*sens. lat*'.

4.8 Statistical Analysis of Quadrat Similarity

Version 4.00 of the multivariate statistical analysis package PATN (Blatant Fabrication, 2013) was used to analyse the floristic data collected within quadrats. In order to define and provide a basis for the grouping of floristic communities into vegetation associations and the determination of mapped vegetation types of the Project Area. The analysis was run using the species cover data in the 15 quadrats across the Project Area. Firstly, the data was transformed using the Natural Log (base e), to normalise the distribution of the data. Using the Bray–Curtis similarity matrix, the sites were then classified based on the flexible unweighted pair-group mean average method (UPGMA, $\beta = -0.1$) with similar species composition. Following the initial data analysis, the species–site similarity matrix was subject to an assessment of the Kruskal Wallis Statistical Scores and a threshold (1.0) was used to exclude less significant taxa from the final analysis. A final Two Step Association Analysis (Austin and Belbin, 1982) was conducted to provide an even more rigorous clear grouping, with a low stress ordination value. A two-way table was derived from the classification for species grouping and the dendrogram presents the site grouping.

Singleton flora records were removed from the data before running the analyses as these are not usually representative of a vegetation association. Some species were also combined or removed before the analyses were carried out because of similarity or current taxonomic uncertainty. Queried taxa for example, were combined with the known species if they were both recorded in the Project Area.

A species accumulation curve of the quadrat data was run to determine whether enough quadrats had been established to cover the species diversity within the Project Area

4.9 Defining Vegetation Associations and Mapping

Floristic community data from the quadrats was grouped together in Association Level V Units for the Vegetation Association Map, based on a combination of Statistical Analysis (See Section **4.8**) and by aligning dominant diagnostic species of each stratum across the quadrats, supported by the relationship of the vegetation units to landform, geology, soils and hydrological conditions. The final map of the extent of Vegetation Associations across the project area is based on high resolution aerial photography (mapping at a scale of 1:10,000), the location of quadrats, site photographs, and relevé notes.

Vegetation associations were digitised using QGIS 3.14 (QGIS Development team 2023), by digitising vector polygons over a high-resolution aerial photography layer (**Figure 4**).

4.10 Describing Vegetation Condition

The Keighery (1994) vegetation disturbance scale was used to determine the condition of vegetated areas within the Survey Area. In accordance with the EPA Guidance (EPA 2016b), the Keighery (1994) vegetation disturbance scale is applied in the south-west and interzone botanical province and ranks vegetation condition from Pristine through to Completely Degraded.

Vegetation condition ratings relate to vegetation structure, level of disturbance in each stratum, and the ability for the vegetation to recover.

The Keighery (1994) vegetation disturbance scale is presented in

Table 7.

Table 7: Keighery vegetation disturbance scale and assessability (Keighery 1994, adapted from EPA 2016a).

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

5 Results

5.1 Desktop Review Results

5.1.1 Threatened and Priority Flora

The database search using EPBC Protected Matters Search Tool (PMST), TPFL and WAHERB database records showed a total of 75 flora records within 20 km of the search area. This consisted of sixteen Threatened species, seven Priority 1, seventeen Priority 2, fifteen Priority 3 and nineteen Priority 4 flora species (DCCEW 2023, DBCA 2022a, DBCA 2022b). These records are shown in **Figure 2.**

Table 8 lists the Threatened and Priority flora species recorded within the 20km radius of the search area in the EPBC Protected Matters, TPFL and WAHERB databases. **Appendix C** presents the full EPBC Protected Matters Database search results. The sixteen species with suitable habitat within the Project Area are highlighted.

Table 8: Threatened and Priority flora recorded within 20km radius of Project Area (DCCEW 2023, DBCA 2022a, 2022b)

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Acacia prismifolia	**Threatened**		August	Rocky slopes.
Banksia brownii	**Threatened**	**Endangered**	Mar to July	Sand over laterite, gravel, loam over granite. In gullies.
Banksia goodii	**Threatened**	**Vulnerable**	May or Nov	White or grey sand over laterite.
Banksia verticillata	**Threatened**	**Vulnerable**	Jan to April	Granite slopes with sandy grey loam over granite. Shrubland with *Agonis flexuosa, Agonis marginata, Dryandra formosa, Eutaxia obovata, Gastrolobium* sp.
Caladenia granitora	**Threatened**	**Endangered**	Oct	Gritty sandy clay, granite. Near low exposed rock outcrops.
Caladenia harringtoniae	**Threatened**	**Vulnerable**	Oct to Nov	Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops.
Calectasia cyanea	**Threatened**	**Critically Endangered**	Jun to Oct	Limestone heath, *Agonis flexuosa, Allocasuarina fraseriana, Banksia sessilis, Phyllanthus calycinus, Adenanthos sericeus, Allocasuarina humilis, Amperea ericoides, Anarthria prolifera, Hibbertia racemosa.* Ridge, sand on limestone, long unburnt.
Chordifex abortivus	**Threatened**	**Endangered**	Sep to Oct	Sandplain behind coast ridge. Deep peaty sand.

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Conostylis misera	**Threatened**	**Endangered**	Oct to Nov	White or grey sand, sandy loam. Winter-wet flats.
Diuris drummondii	**Threatened**	**Vulnerable**	*Nov to Dec/Jan*	*Agonis parviceps* tall shrubland. Winter wet swamp, black sand over granite.
Drakaea micrantha	**Threatened**	**Vulnerable**	*Sep to Oct*	*Allocasuarina fraseriana, Eucalyptus staeri* low woodland in association with *Banksia coccinea* thicket. *Jacksonia spinosa, Anarthria scabra, Dasypogon bromeliifolius, Melaleuca thymoides*. Gentle slope. Deep white sand.
Isopogon uncinatus	**Threatened**	**Endangered**	Oct to Nov	Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.
Kennedia glabrata	**Threatened**	**Vulnerable**	Aug to Nov	Soil pockets, sandy soils. Granite outcrops.
Microtis globula	**Threatened**	**Vulnerable**	Dec or Jan	Peaty soils. Winter-wet swamps.
Sphenotoma drummondii	**Threatened**	**Endangered**	Sep to Dec	Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.
Verticordia fimbrilepis subsp. *australis*	**Threatened**	**Vulnerable**	Oct to Dec	Shallow sand, clay loam. Granite outcrops.
Caladenia evanescens	**P1**		Nov	Sand. Consolidated sand dunes.
Drosera paleacea	**P1**		Sep to Dec/Jan	Grows in black sandy soils on winter wet flats.
Prasophyllum paulinae	**P1**		Oct	Soil, sand. In association with *Eucalyptus* sp. and *Agonis* sp.
Schoenus sp. Grey Rhizome	**P1**		Oct	Low rise, damp white-grey sand. Low heath with *Evandra aristata*, sedges, rushes, *Baxteria*.
Thomasia multiflora	**P1**		Sep to Oct	Black sand. Seasonally wet areas, granite outcrops.
Thomasia purpurea x solanacea	**P1**		Nov to Dec or Jan	Flat track side, calcrete sand over limestone. Peppermint heath.
Usnea pulvinata	**P1**		NA	Lichen on Outcrops. Bare, moist brown shallow clay-loam. Granite 70% of area.
Agrostocrinum scabrum subsp. *littorale*	**P2**		Nov to Dec	Open granite heath. Large granitic rocks. Granitic loam over granite.

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Bossiaea sp. Mt Frankland	**P2**	**Endangered**	Nov	Karri Forest/Deep yellow sand
Calandrinia sp. Torndirrup	**P2**		Nov	Grey sand / peat. Damp seep
Conospermum quadripetalum	**P2**		Sep to Nov	Grey sand, flat land between coast hills. *Dampiera linearis.*
Conospermum spectabile	**P2**		Oct to Nov	Sandy soils. (Stirling Range)
Degelia flabellata	**P2**		NA	Lichen on exposed granite rock outcrop.
Gyrostemon thesioides	**P2**		Nov	Grey sand. *Agonis flexuosa*. Consolidated coastal dunes.
Hydrocotyle serendipita	**P2**		Nov	SW slope. In granite sand enriched by charcoal from a fire 12 months ago. Woodland.
Isopogon buxifolius var. buxifolius	**P2**		Jul to Dec	Grey sand. Swampy areas.
Leucopogon bracteolaris	**P2**		Feb/May/Jul or Oct	Stony sand, gravelly loam, King George Sound
Pterostylis heberlei	**P2**		Aug/Sep	Coastal peppermint woodland.
Schoenus sp. Grassy	**P2**		June	Flat winter wet ground, dark grey/black sandy loam
Stenanthemum sublineare	**P2**		Oct to Dec	Flat, grey-brown sandy loam.
Stylidium articulatum	**P2**		Nov to Dec	Sandy loam, granite. Hills, coastal heath.
Stylidium falcatum	**P2**		Oct to Nov	Sand, gravelly clay loam. Plains, lateritic ridges.

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Styphelia cymbiformis	**P2**		Dec	Woodland, Dry white sand over laterite/granite
Thelymitra porphyrosticta	**P2**		Aug	In association with *Eucalyptus* sp. and *Casuarina* sp. Sandy slopes.
Acacia ataxiphylla subsp. *ataxiphylla*	**P3**		Nov to Dec/Jan	Flat, damp grey sand over clay. Eucalypt woodland
Amanita drummondii	**P3**		*May*	*Eucalyptus staeri* Woodland
Andersonia auriculata	**P3**		Apr to Oct	Grey or peaty sand, often over laterite. Swampy areas, granite outcrops.
Andersonia setifolia	**P3**		Sep	In association with *Gastrolobium* sp. and *Acacia* sp. Gravel soil.
Austrostipa mundula	**P3**		Nov	Plateau of coastal cliffs. Shallow cream sand and limestone over Proterozoic granite-gneiss.
Boronia crassipes	**P3**		Aug to Dec	Wet peat swamp. In association with *Beaufortia sparsa* and rushes.
Chorizema carinatum	**P3**		Oct to Dec	Jarrah Forest, Grey sandy loam with laterite.
Juncus meianthus	**P3**		Nov to Dec/Jan	Fresh water seepage. Albany.
Lachnagrostis billardierei subsp. *billardierei*	**P3**		Dec	Saline, upper tidal zone, sand. Coastal *Melaleuca cuticularis* woodland.
Leucopogon alternifolius	**P3**		Sep	In swamp.
Leucopogon altissimus	**P3**		Aug to Dec	Woodland. *Agonis flexuosa, Allocasuarina fraseriana, Anarthria scabra*.

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Poa billardierei	**P3**		Nov to Dec	Foredune. Deep beach sand. *Isolepis nodosa, Euphorbia paralias, Carpobrotus* sp.
Synaphea incurva	**P3**		Sep to Nov	Gravelly loam, sandy soils. Slopes.
Synaphea preissii	**P3**		Sep	Steep S slope. Grey sand over granite. Coastal heath with *Dasypogon,* sedges, *Dryandra.*
Verticordia endlicheriana var. *angustifolia*	**P3**		Oct to Nov	Sandy clay. Granite outcrops.
Adenanthos xcunninghamii	**P4**		Mar/Sep to Oct	In association with *Agonis* sp. and *Dryandra* sp. Sandy soil.
Andersonia sp. Jamesii	**P4**		Aug to Sep	Flat, grey loamy clay.
Asplenium decurrens	**P4**		NA	3 Torndirrup NPk (R 24258). Peak Head. 1m deep in a vert. crevice c. 100m ASL. Albany.
Banksia seneciifolia	**P4**		Jun or Aug	Ridge. Laterite. Woodland.
Banksia serra	**P4**		Jul to Sep	Gravel, sand or clay loam over laterite. Hillslopes.
Corysanthes limpida	**P4**		Aug	Stabilised dune. Dense scrub. Under *Agonis flexuosa.*
Drosera fimbriata	**P4**		Sep to Oct	Grey sand on the edge of a fire break. Low shrubland.
Gahnia sclerioides	**P4**		Apr	Well drained middle slope, dark grey sand, coastal hills. Loam, sandy soils. Moist shaded situations.
Gonocarpus pusillus	**P4**		Nov to Dec	Sandy peat swamp.
Gonocarpus simplex	**P4**		Nov to Dec	Very gentle slope, edge of drainage valley, chocolate brown peat soil over sand, wet.

Taxon Name	WA Ranking	EPBC Ranking	Flowering period (Albany)	Habitat type^
Kunzea pauciflora	**P4**		Aug to Nov	In clay over limestone.
Lepidium pseudotasmanicum	**P4**		*Feb or Dec*	*Eucalyptus megacarpa* low woodland/Hillslopes, loam over granite
Lysinema lasianthum	**P4**		Jul to Nov	In peaty soil. Swamp.
Microtis pulchella	**P4**		Nov to Dec	Burnt swamps and damp shrublands
Microtis quadrata	**P4**		Dec	Swamps
Spyridium spadiceum	**P4**		Aug to Dec or Jan to Feb/Apr	Sand over limestone on a clifftop by seashore.
Thomasia quercifolia	**P4**		Sep to Dec	Mixed low shrubland of *Acacia littorea, Spyridium majoranifolium with Dryandra sessilis, Scaevola nitida, Desmocladus flexuosa*. Flat ridge top, grey sand over outcropping limestone.
Thomasia solanacea	**P4**		Sep to Dec	Low forest. With *Eucalyptus megacarpa, Agonis flexuosa, Chorilaena quercifolia, Spyridium globulosum, Lepidosperma effusum* forma small. Brown sandy loam.
Thysanotus isantherus	**P4**		Nov to Dec	Granite, Growing in grey sand over gneiss on a flat rise behind the beach.

^The sixteen species with suitable habitat within the Project Area are highlighted.

5.1.2 Threatened and Priority Ecological Communities

The database search using EPBC PMST and DBCA TEC custom database search listed seven conservation significant ecological communities within a 20 km buffer of the project area (DCCEW 2023, DBCA 2022c), as listed in **Table 9** and shown in **Figure 3**.

Table 9: Priority and Threatened Ecological Communities recorded within 20km radius of the Project Area (DCCEW 2023, DBCA 2022c)

Community Name	WA listing	*EPBC* Act
Astartea scoparia Swamp Thicket	**P1**	
Banksia coccinea Shrubland/*Eucalyptus staeri*/Sheoak Open Woodland (Community 14a - Sandiford & Barrett 2010)(all/or portion in EPBC listed Kwongkan community)	**P1**	**Endangered**
Banksia littoralis woodland / *Melaleuca incana* Shrubland	**P1**	
Banksia occidentalis/Kunzea clavata shrubland	**P1**	
Coastal *Melaleuca incana / Taxandria juniperina* Shrubland/Closed Forest	**P1**	
Melaleuca spathulata/Melaleuca viminea Swamp Heath	**P1**	
Subtropical and Temperate Coastal Saltmarsh	**P3**	**Vulnerable**

5.1.3 Environmentally Sensitive Areas

The closest ESA to the Project Area is the population of Rare Flora (Critically Endangered) *Calectasia cyanea* 500 m to the north (DBCA 2022b) as shown in **Figure 2**. This population (Pop ID 84590) consists of a few plants and was recorded flowering by Eco Logical in 2020. The C. *cyanea* record in the Wind Farm carpark, 80 m to the north is a historical herbarium record from 2009 (Sheet ID 8518580).

5.1.4 Introduced Flora

The City of Albany recognizes 8 Weeds of National Significance (WoNS) under the BAM Act (2007) (DPIRD, 2023) **(Table 10**).

Table 10: Introduced flora recorded within the City of Albany (2019)

Species	Status (DPIRD, 2023)
Asparagus aethiopicus (Asparagus Fern)	
Asparagus asparagoides (Bridal Creeper)	
Asparagus declinatus (Bridal Veil)	Permitted – s11
Asparagus scandens (Asparagus Fern)	
Lantana camara (Lantana)	
Rubus spp. (Blackberry)	
Sagittaria platyphylla (Arrowhead)	Declared pest -s22(2)
Ulex europaeus (Gorse)	

5.2 Field Survey Results

5.2.1 Flora Identified

A total of 163 species of Flora from 111 Plant Genera and 48 Plant Families were recorded across the Project Area. Of these, 40 taxa (24%) were from single collections across the quadrats and another 57 taxa (34%) were only recorded from opportunistic collections (outside the quadrats). This reflects the high diversity of ephemeral forbs and the mosaicking of vegetation units. Adding to this count was the roadside/rehabilitation/track flora (including exotics), which were also recorded opportunistically.

The most common plant families were Asteracaeae, Cyperaceae, Fabaceae, Poaceae and Proteaceae. The genera *Hibbertia* (5 spp.), *Hakea* (5 spp.), *Lepidosperma* (4 spp.), *Leucopogon* (4 spp.) and *Senecio* (4 spp.) were the most species diverse.

The species that were most widespread across the Project Area (most frequently occurring within vegetation associations/quadrats) were *Bossiaea linophylla* and *Spyridium globulosum* which occurred in 14 of the 15 quadrats. Other common species included *Desmocladus flexuosus* (13 Quadrats), *Opercularia hispidula* (12 Quadrats) and *Acacia littorea* (12 Quadrats). *Agonis flexuosa* was the most dominant flora species with up to 60% cover ($\bar{X}$ 28%) across 7 quadrats, followed by *Desmocladus flexuosus* with up to 50% cover across 13 quadrats ($\bar{X}$ 16%) and *Eucalyptus angulosa* up to 75% cover across 5 quadrats ($\bar{X}$ 41%).

Due to insufficient or inadequate flowering and/or fruiting material, taxonomic uncertainty, a number of taxa (21 specimens or 13% of the collections) could not be confirmed. The identity of such has been left queried (?) at species/subsp. level or stated as indeterminant species (sp.). These species include *Austrostipa, Corysanthes, Drakaea, Drosera, Lomandra* which often flower at other times of the year.

A complete list of all recorded flora is included in **Appendix D**. The quadrat data is presented in **Appendix E** and the Species by Site Matrix is Present in **Appendix F**.

5.2.2 Threatened and Priority Flora Recorded

Two Priority flora species were recorded within the Project Area. *Adenanthos* x*cunninghamii* (P4) and *Thomasia quercifolia* (P4).

These two flora species were identified at the time of the primary survey. The recorded distribution and density of each is shown in **Figure 5**. Systematic traverses at ~50m spacing to cover as much of the Project Area as possible were undertaken to check all habitats within the Project Area and where possible intersect species of conservation significance as shown in **Figure 4**. Conservation codes for flora can be found in **Appendix A.**

5.2.2.1 *Adenanthos xcunninghamii* (P4)

Commonly known as Albany Woolly Bush or Prostrate Woolly Bush, this Priority 4 species is a natural hybrid between *Adenanthos sericeus* and *A. cuneatus*. It has a spreading growth habit 1-1.5m in height and 1-2m wide with small red/pink flowers, Sept – October. It occurs in grey sand on coastal dunes (WaHerb 2023). Two individuals were recorded in the centre of the Project Area, opportunistic to Q4 in Heathland of the Vegetation Association Peppermint Low Forest/Heath Mosaic. It is noted these individuals may occur at the boundary between Coastal Heath (ARVS 3a) (*A. cuneatus*) and Coastal Limestone Tall Shrubland (ARVS 5a) (*A. sericeus*) where cross over pollination between the two *Adenanthos* parent populations is likely. There is a mosaic of these communities throughout the Peppermint Low Forest/Heath Mosaic. Targeted traversing was conducted around the edges of the Vegetation Association Coastal Heath south of the central fire track (**Figure 4**), where no further individuals were detected, however early successional fire recovery in this area (Fire in early 2018), means *Adenanthos* seedings are not easily differentiated in passing.

Photo 1: *Adenanthos xcunninghamii* (P4) habit, within the Project Area

Photo 2: *Adenanthos* x*cunninghamii* (P4) closeup, within the Project Area

5.2.2.2 *Thomasia quercifolia* (P4)

Oak leaved Thomasia is a shrub to 1m high (WaHerb 2023). Five populations were recorded within the Project Area, with population estimates in each of 60+, 35+, 150+, 35+ and 10+ individuals as shown in **Figure 5**. This species occurred in Coastal Limestone Heath on the more exposed dune crests, with shallow soils over limestone. One population was recorded in *Eucalyptus angulosa* forest in a dune swale. The closest known population is 400m to the northwest of Q15 (ID 9428194, WaHerb 2023). It was also recorded in the Eco Logical (2020) survey of the windfarm with 500+ individuals recorded at each of two wind turbines 6 and 8 in Coastal Limestone Heath (ARVS 5b).

Photo 3: *Thomasia quercifolia* (P4) within the Project Area

Photo 4: *Thomasia quercifolia* (P4) closeup within the Project Area

5.2.3 Flora of Other Conservation Significance

There were no flora collections that represent substantial range extensions (RE, >20km) or infill locations to the known extent of the species as listed on Florabase (WA Herbarium 2023). No flora collections from the primary survey are poorly known or poorly collected that would otherwise need to be lodged with the herbarium.

5.2.4 Vegetation Associations

Fifteen vegetation quadrats were established across the Project Area. The quadrat data is presented in **Appendix E.** The species by site matrix is present in **Appendix F.**

Five vegetation associations were defined for the Project Area as detailed in **Table 11.** A Summary of the extent of the vegetation associations is presented in **Table 12.** These vegetation associations were grouped based on the floristic classification results of the Dendrogram (**Appendix G)** and NVIS Structural Information common between the FCTs of each group based on diagnostic dominant species in the species by site matrix (**Appendix F**). Additionally, the corresponding landform and geology were used to characterise the groupings. The mapping of the vegetation associations is shown in **Figure 4**. Where the Vegetation Associations match the vegetation units of the ARVS they are indicated in **Table 11.**

Two of the Vegetation Associations of the Project Area are mosaics of heath and woodland, where the rapid patterning of changes in form and species composition cannot be differentiated at a meaningful scale. Fire has also altered the structure and species composition along Sand Patch Road, south over the first dunal ridge (fire in early 2021) and south of the central firebreak track (established to fight fire in early 2018).

The vegetation association 'Peppermint Low Forest/Heath Mosaic' was the most widespread with a coverage of 11.178 ha or 40.83% of the Project Area. The most restricted vegetation associations were 'Limestone Mallee' (0.496 ha, 1.81% of the Project Area) along with 'Coastal Limestone Heath (0.614 ha, 2.24% of the Project Area). See **Photo 5** for an overview of the vegetation of the Project Area.

In the ARVS (2010) Limestone Mallee (6) was recorded on limestone outcrops along the coastal dune system, distinguished by a dense canopy of *Eucalyptus goniantha* subsp. *goniantha* and *Eucalyptus angulosa* with *Melaleuca pentagona* the dominant shrub. Only four relevés were established in this vegetation unit as part of the regional study, so the characteristics of 'Limestone Mallee' within the Project Area may not be represented. Within the Project Area, *E. angulosa* stands were mosaiced with *Agonis flexuosa* across large areas (10.662ha). *Melaleuca pentagona* was not a component of the shrub layer, except for an area close to Sand Patchroad (near Q14). Eco Logical (2020) reported that '*Eucalyptus angulosa* low mallee woodland' in areas surrounding the wind turbines did not resemble any vegetation units defined in the ARVS.

'Coastal Limestone Heath' within the Project Area is equivalent to the Coastal Limestone Heath 5b of the ARVS. This sub-unit occurs on shallower and more exposed areas. *Thomsaia quercifolia* (P4) is a diagnostic shrub in this subunit and was dominant within this vegetation association within the Project Area. It is restricted to the coastal fringe on the Meerup landform unit (ARVS, Sandiford and Barrett, 2010).

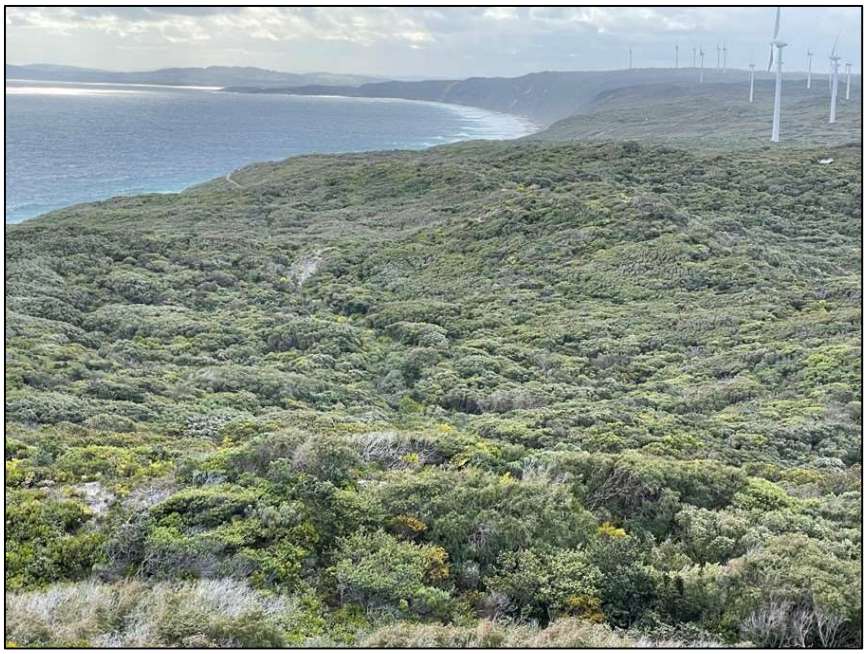
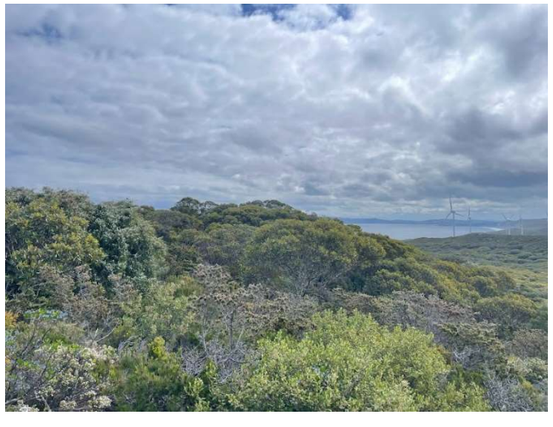


Photo 5: Vegetation of the Project Area looking Northwest from -35.06818328, 117.80524393

Table 11: Vegetation Associations Mapped in the Project Area

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
Coastal Heath (ARVS 3a)	Mid to tall open shrubland of *Adenanthos sericeus* subsp. *sericeus* over heathland of *Spyridium globulosum/ Spyridium majoranifolium, Allocasuarina lehmanniana* subsp. *lehmanniana/* ***Allocasuarina humilis, Leucopogon obovatus*** **subsp.** ***revolutus,*** *Acrotriche cordata* open sedgeland of *Desmocladus flexuosus* and *Lepidosperma squamatum* with isolated forbs of ***Hibbertia racemosa,*** *Opercularia hispidula, Platysace compressa,* ***Orianthera serpyllifolia*** subsp. *serpyllifolia* and *Conostylis aculeata* subsp. *aculeata* on fine grey sand of a steep **dune slopes**. Mean Species Richness **27**		**02**	Tall open shrubland of *Adenanthos sericeus* subsp. *sericeus* over open mid heathland of *Allocasuarina lehmanniana* subsp. *lehmanniana, Leucopogon reflexus, Olearia axillaris, Spyridium globulosum, Acacia littorea* and *Bossiaea linophylla* over open sedgeland of *Desmocladus flexuosus* and *Lepidosperma squamatum* on fine grey sand of a steep dune slope **Species richness: 28**
			**05**	Sparse mid shrubland of *Anthocercis littorea, Adenanthos sericeus* subsp. *sericeus* over low heathland of *Acrotriche cordata, Acacia cochlearis, Spyridium majoranifolium* and *Trymalium ledifolium* var. *rosmarinifolium* over low open heathland of *Pimelea ferruginea* and *Platysace compressa* over open sedgeland of *Lepidosperma squamatum* and *Desmocladus flexuosus* with isolated forbs of *Hibbertia racemosa* and *Conostylis aculeata* subsp. *aculeata* on white grey fine sand of a dune crest (in recovery from 2018 fire). **Species richness: 28**

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
			12	Mid open shrubland of *Spyridium globulosum, Allocasuarina humilis, Adenanthos sericeus* subsp. *sericeus, Leucopogon obovatus* subsp. *revolutus* and *Banksia sessilis* over low sparse shrubland of *Acrotriche cordata* and *Acacia littorea* over sedgeland of *Desmocladus flexuosus* with isolated clumps of forbs of *Opercularia hispidula, Platysace compressa, Orianthera serpyllifolia* subsp. *serpyllifolia* and *Hibbertia racemosa* on fine grey sand of dune crest. **Species richness: 25**
Coastal Limestone Heath (ARVS 5b)	Tall isolated shrubland of *Adenanthos sericeus* subsp. *sericeus* over mid open shrubland of *Spyridium globulosum, Allocasuarina lehmanniana* subsp. *lehmanniana, Leucopogon parviflorus* and *Scaevola nitida* over low shrubland of ***Thomasia quercifolia*** *(P4), Pultenaea tenuifolia, Acacia littorea, Acrotriche cordata* and *Leucopogon obovatus* subsp. *revolutus* over open sedgeland of *Desmocladus flexuosus* with ***Netrostylis*** sp. Mt Madden and sparse forbs of *Opercularia vaginata* and *Conostylis aculeata* subsp. *aculeata/ Hibbertia grossulariifolia* on shallow grey fine sand of dune crest with underlying **limestone**/ limestone outcropping. Mean Species Richness **31**		**07**	Tall sparse shrubland of *Adenanthos sericeus* subsp. *sericeus* over mid open shrubland of *Spyridium globulosum, Allocasuarina lehmanniana* subsp. *lehmanniana, Leucopogon parviflorus* and *Scaevola nitida* over low shrubland of *Thomasia quercifolia, Acacia littorea, Acrotriche cordata* and *Leucopogon obovatus* subsp. *revolutus* over open sedgeland of *Desmocladus flexuosus* and sparse forbs of *Opercularia vaginata* and *Conostylis aculeata* subsp. *aculeata* on fine grey sand of a dune crest. **Species richness: 38**
			13	Mid sparse shrubland of *Adenanthos sericeus* subsp. sericeus, *Allocasuarina lehmanniana* subsp. *lehmanniana, Acacia littorea* and *Spyridium globulosum* over low open shrubland of *Acrotriche cordata, Thomasia quercifolia* and *Pultenaea tenuifolia* over isolated sedges of *Desmocladus flexuosus, Netrostylis* sp. Mt Madden and *Chaetospora subbulbosa* with isolated clumps of forbs of *Opercularia vaginata* and *Hibbertia grossulariifolia* on shallow grey fine sand of limestone outcrop. **Species richness: 25**

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
			**15**	Tall isolated shrubland of *Adenanthos sericeus* subsp. *sericeus,* over mid open shrubland of *Spyridium globulosum, Scaevola nitida* and *Leucopogon parviflorus* over low open shrubland of *Acrotriche cordata, Thomasia quercifolia, Acacia littorea, Logania fasciculata* and *Pultenaea tenuifolia* over sparse sedgeland of *Netrostylis* sp. Mt Madden and *Desmocladus flexuosus* with sparse forbland of *Opercularia vaginata* and sparse tussock grassland of *Poa poiformis* on fine grey sand of coastal dune slope. **Species richness: 31**
Limestone Mallee/Coastal Limestone Heath Mosaic **(ARVS 6/5ab)**	Mallee woodland of ***Agonis flexuosa*** **with** ***Eucalyptus angulosa*** over tall open shrubland of ***Bossiaea linophylla, Spyridium globulosum*** and ***Adenanthos sericeus*** **subsp.** ***sericeus*** over sparse mid shrubland of ***Hakea oleifolia, Allocasuarina lehmanniana*** **subsp.** ***lehmanniana*** and *Leucopogon obovatus* subsp. *revolutus* with *Clematis pubescens* creepers over isolated low shrubs of *Opercularia hispidula* over open sedgeland of ***Lepidosperma gladiatum*** and *Desmocladus flexuosus* in fine grey sand of **swales /hollows** and **lower dunal slopes.** Mean Species Richness **18**		**01**	Low Open Forest of *Agonis flexuosa* over tall open shrubland of *Adenanthos sericeus, Spyridium globulosum* and *Bossiaea linophylla* over sedgeland of *Lepidosperma gladiatum* on grey sand of a dune swale. **Species richness: 18**
			**Q8**	Open mallee forest of *Eucalyptus angulosa* over open tall shrubland of *Bossiaea linophylla* and *Adenanthos sericeus* subsp. *sericeus* with *Clematis pubescens* creepers over sparse mid shrubland of *Hibbertia furfuracea* and *Leucopogon obovatus* subsp. *revolutus* over sedgeland of *Desmocladus flexuosus* and *Gahnia* sp. Headland on grey fine sand of upper dune slopes. **Species richness: 22**

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
			**11**	Mallee woodland of *Agonis flexuosa* with *Eucalyptus angulosa* over tall open shrubland of *Bossiaea linophylla, Spyridium globulosum* and *Adenanthos sericeus* subsp. *sericeus* over sparse mid shrubland of *Hakea oleifolia, Allocasuarina lehmanniana* subsp. *lehmanniana* and *Leucopogon obovatus* subsp. *revolutus* over isolated low shrubs of *Opercularia hispidula* over open sedgeland of *Lepidosperma gladiatum* and *Desmocladus flexuosus* in fine grey sand of swales /hollows and lower dunal slopes. **Species richness: 14**
Limestone Mallee	Closed mallee forest of ***Eucalyptus angulosa*** **and** ***Agonis flexuosa*** over open mid shrubland of ***Hibbertia furfuracea*** and *Bossiaea linophylla/ Leucopogon obovatus* subsp. *revolutus* with climbing ***Clematis pubescens*** over sparse sedgeland of *Lepidosperma gladiatum, Lepidosperma squamatum* and *Desmocladus flexuosus* on grey fine sand of **steep southern dunal slope**. Mean Species Richness **12**		**03**	Open mallee forest of *Eucalyptus angulosa* with *Agonis flexuosa* over tall sparse shrubland of *Spyridium globulosum* over mid heathland of *Hibbertia furfuracea, Leucopogon obovatus* subsp. *revolutus* and *Bossiaea linophylla* with climbing *Clematis pubescens* over sparse sedgeland of *Lepidosperma squamatum* and *Desmocladus flexuosus* on brown sandy loam with deep leaf litter on southern side of dune slope. **Species richness: 14**
			**10**	Closed mallee forest of *Eucalyptus angulosa* and *Agonis flexuosa* over open mid shrubland of *Hibbertia furfuracea* and *Bossiaea linophylla* over sparse sedgeland of *Lepidosperma gladiatum, Lepidosperma squamatum* and *Desmocladus flexuosus* on grey fine sand of steep southern dunal slope. **Species richness: 11**

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
Peppermint Low Forest/Coastal Heath Mosaic (ARVS 2/3/5ab)	Low open mallee woodland of ***Agonis flexuosa*** sparse tall shrubs of ***Adenanthos sericeus* subsp. *sericeus*** *over* Heathland of *Allocasuarina humilis, Bossiaea linophylla/Acacia littorea,* ***Jacksonia horrida/Banksia sessilis, Adenanthos cuneatus, Melaleuca thymoides,*** *Leucopogon obovatus* subsp. *revolutus* and *Hibbertia furfuracea* over open sedgeland of ***Anarthria prolifera,*** *Schoenus caespititius* and *Lepidosperma squamatum* with isolated forbs of *Hibbertia racemosa* and *Lysiandra calycina/ Lagenophora huegelii* on fine grey sand of a gentle slope of an interdunal saddle/dunes slopes. Mean Species Richness **27**		**06**	Low open mallee woodland of *Agonis flexuosa* over closed mid heathland of *Scaevola nitida, Acacia littorea, Bossiaea linophylla, Banksia sessilis* and *Gyrostemon sheathii* over low open shrubland of *Pimelea rosea* subsp. *rosea* and *Leucopogon reflexus* over isolated clumps of sedges of *Lepidosperma gladiatum* on fine grey sand of a lower slope/dune swale (in recovery from 2018 fire). **Species richness: 18**
			**14**	Isolated clumps of low mallee trees of *Agonis flexuosa* over sparse tall shrubs of *Adenanthos sericeus* subsp. *sericeus* over mid sparse shrubland of *Melaleuca pentagona* var. *pentagona* over low open shrubland of *Pimelea rosea* subsp. *rosea, Melaleuca thymoides*, *Gyrostemon sheathii, Adenanthos cuneatus* and *Scaevola nitida* over isolated forbs of *Opercularia hispidula, Senecio pinnatifolius* var. *latilobus, Lysiandra calycina* and *Hibbertia racemosa* on fine grey sand of a dunal ridge. **Species richness: 39**
			**04**	Heathland of *Allocasuarina humilis, Bossiaea linophylla, Jacksonia horrida, Leucopogon obovatus* subsp. *revolutus* and *Hibbertia furfuracea* over low sparse shrubland of *Lysinema pentapetalum* and *Leucopogon reflexus* over open sedgeland of *Anarthria prolifera, Schoenus caespititius* and *Lepidosperma squamatum* with isolated forbs of *Hibbertia racemosa* and *Lagenophora huegelii* on fine grey sand of a gentle slope of an interdunal saddle. **Species richness: 31**

Mapping Code	Vegetation Association Description (NVIS TWG 2017)	Photos	Quadrat	Floristic Community Description
			**09**	Mallee woodland of *Agonis flexuosa* with Isolated *Eucalyptus angulosa,* over isolated tall shrubs of *Adenanthos sericeus* subsp. *sericeus* over sparse mid shrubland of *Bossiaea linophylla*, *Leucopogon obovatus* subsp. *revolutus* and *Banksia sessilis* over sparse low shrubland of *Adenanthos cuneatus, Melaleuca thymoides, Jacksonia horrida* and *Allocasuarina lehmanniana* subsp. *lehmanniana* over sparse sedgeland of *Anarthria prolifera, Schoenus caespititius, Desmocladus flexuosus* and *Lepidosperma squamatum* on fine grey sand of upper dunal slopes. **Species richness: 22**

Table 12: Summary of Vegetation Associations in the Project Area

Vegetation Association	Quadrats	Area (Ha)	Percent of Project Area (%)
1. Coastal Heath	**2, 5, 12**	5.579	20.38
2. Coastal Limestone Heath	**7, 13, 15**	0.614	2.24
3. Limestone Mallee/Coastal Limestone Heath Mosaic	**1, 8, 11**	8.99	32.84
4. Limestone Mallee	**3, 10**	0.496	1.81
5. Peppermint Low Forest/Coastal Heath Mosaic	**4, 6, 9, 14**	11.178	40.83
6. Cleared/Rehabilitation/Fire Track		0.519	1.90
		27.379	**100**

5.2.5 Threatened and Priority Ecological Communities

There are no TECs or PECs recorded within the Project Area. There was no match of vegetation associations of the Project Area with conservation significant ecological communities recorded within 20km of the Project Area (DBCA 2022c).

5.2.6 Species Diversity within Vegetation Associations

Species richness within the quadrats varied from 11 to 76 taxa, with an average richness of 24.267 ± 8.46 (SD) taxa per quadrat. The vegetation association with the highest average species richness was 'Coastal Limestone Heath' (25-38 taxa per quadrat). The lowest species diversity of 14 and 11 taxa was recorded in Quadrats 3 and 10 of 'Limestone Mallee' which were dominated by dense canopy of Eucalypt/*Agonis* and largely monospecific shrub and sedge layers. Within the AVRS (2010), the Peppermint Low Forest (2) is considered the climax community of Coastal Heath and had the lowest mean species richness of 10 spp.

A high proportion of the species diversity within the quadrats were from single collections across the quadrats (40 taxa (24%) and another 57 taxa (34%) were only recorded from opportunistic collections (outside the quadrats). This reflects the high diversity of ephemeral flora that is occasional, emergent in open areas/different stages of succession/ fire recovery, a mosaicking that is not able to be captured in limited quadrats. This includes Orchids (including unidentified leaves as shown in **Photo 6** and **Photo 7**), Lomandra, Drosera and various Poaceae species. The species per site matrix is presented in **Appendix F**.

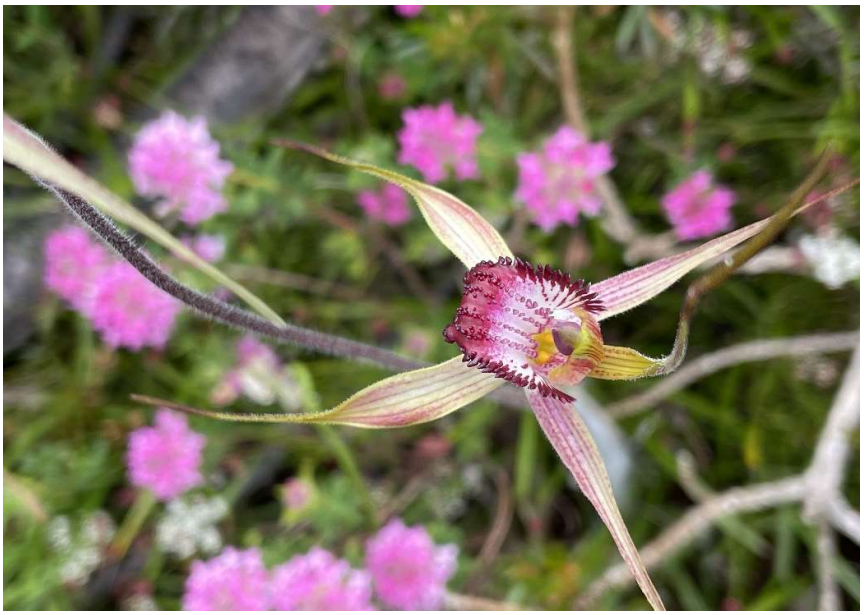


Photo 6: Occasional orchid species, *Caladenia applanata* subsp. *applanata* within 'Peppermint Low Forest/Coastal Heath Mosaic'

Photo 7: Orchid species (leaves only/unburnt area), within 'Peppermint Low Forest/Coastal Heath Mosaic'

5.2.7 Vegetation Condition

The vegetation of the Project Area is in the majority in Excellent condition (>96% of the Project Area) as listed in **Table 13**. Weeds are restricted to areas along Sand Patch Road (weed incursion due to fire in 2021) and the central firebreak track that was established in early 2018 (fire recovery south of this track). Vegetation condition is shown in **Figure 5.**

Table 13: Area statement of Vegetation Condition Ratings in the Project Area

Condition Rating	Area (Ha)	% of Project Area
Excellent	26.429	96.53
Very Good	0.95	3.47
Total	**27.379**	**100**

5.2.8 Introduced Flora

Twenty-five introduced flora species (including one yet to be confirmed species) were recorded during the survey as summarised in **Table 14**. These species were recorded opportunistically along the central fire track or along the roadside vegetation of Sand Patch Road. None of these species are listed as Weeds of National Significance (Weeds Australia 2023), or Declared Pest s22(2) (C3 Restricted) in WA under the BAM Act (DPIRD 2023). All species were listed as "Permitted" (Permitted organisms must satisfy any applicable import requirements when imported. They may be subject to an import permit if they are potential carriers of high-risk organisms) under section 11 of the BAM Act (DPIRD 2023) (**Table 1, Table 2**).

Table 14: Summary of introduced flora recorded in the Project Area

Scientific Name	Common name	Location Firebreak Track / Sand Patch Road	
Aira praecox	Early Hairgrass	X	
Briza maxima	Quaking grass	X	X
Briza minor	Shivery Grass	X	X
Bromus diandrus	Great Brome	X	X
Centranthus ?macrosiphon	Pretty Betsy, Spanish Valerian		X
Cerastium glomeratum	Mouse Ear Chickweed	X	
Dischisma arenarium	NA	X	
Dittrichia viscosa	False yellowhead/Aromatic inula		X
Ehrharta longiflora	Annual veld grass	X	X
Fumaria muralis subsp. *muralis*	Wall fumitory	X	X
?*Gladiolus* sp (Note *Gladiolus undulates* is found in Albany)	?Wavy Gladiolus		X

Scientific Name	Common name	Location Firebreak Track / Sand Patch Road	
Geranium molle	Soft cranesbill, Dove's foot cranesbill	X	
Heliophila pusilla	Heliophila		X
Hypochaeris ?radicata	?Spotted cat's ear, smooth cat's ear, hairy wild lettuce, flatweed, catsear.	X	
Hypochaeris glabra	smooth catsear, flatweed	x	
Lagurus ovatus	Hare's Tail Grass	x	
Lysimachia arvensis	Scarlet pimpernel, pimpernel, blue pimpernel	X	X
Orobanche minor	Lesser Broomrape		X
Pelargonium capitatum	Wild pelargonium.	X	X
Romulea rosea var. *australis*	Onion grass, Guildford grass	X	X
Senecio elegans	Redpurple ragwort, purple ragwort, purple groundsel	X	X
Silene gallica var. *gallica*	Small catchfly, common catchfly, French catchfly		X
Sonchus oleraceus	Milk thistle, common sow thistle, annual sow thistle.	X	
Trachyandra divaricata	Dune onion weed	X	
Vulpia myuros	Rat's tail fescue	X	

One weed species recorded *Centranthus ?macrosiphon* along Sand Patch Road is a potentially new incursion into Western Australia of another member of the *Centranthus* genus as the flower and leaf morphology is not consistent with the specimens held at the WA Herbarium (Mike Hislop, Accession Ref # 10059/E). The Herbarium would like this specimen submitted for further study. This potential new weed species will need to be monitored for invasiveness. The specimen is shown in **Photo 8.**

Photo 8: *Centranthus ?macrosiphon* recorded along Sand Patch Road

5.3 Survey Limitations

The potential limitations of the survey, as outlined in the EPA Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b) are listed in **Table 15** and their impacts discussed in Section **6** - Discussion.

Table 15: Discussion of potential limitations to the survey (adapted from EPA 2016b)

Potential Limitation	Impact and Discussion
Availability of contextual information at a regional and local scale	Not a Limitation A desktop study was carried out to gather contextual information at a regional and local scale. Pre-European vegetation mapping and regional vegetation unit mapping are also available for the vicinity of the Project Area (Torndirrup). Searches of DBCA's threatened flora and ecological community databases, and a search using the EPBC Act Protected Matters Search Tool were carried out. There are substantial Herbarium held records within the vicinity. A botanical survey of the adjacent Wind Farm was conducted by Eco Logical in 2020.
Competency and experience of the team carrying out the survey, including experience in the bioregion surveyed	Not a Limitation The field survey was carried out by suitably qualified and experienced Botanist, Vanessa Yeomans (BSc. Hons Botany, 15+ years' experience) who has extensive experience in Botany throughout Western Australia, including prior surveys conducted in the Warren Bioregion. With assistance from C. Luscombe who has local knowledge of flora (Nindethana Seeds). Shibi Chandran a Plant Taxonomist with 5+ years' experience (M. Biology) conducted many of the flora identification with confirmation as required from Mike Hislop of the WA Herbarium.
Proportion of flora recorded and/or collected, any identification issues or taxonomic uncertainty	Partial Limitation The quadrat-based survey was undertaken in accordance with EPA Guidance (2016b). Plant specimens were collected as reference material for each quadrat/when botanists were unable to confirm identification of plants in the field. A species accumulation curve which plots species richness vs sampling effort can be used to indicate the adequacy of the quadrat-based flora survey. After surveying 15 quadrats, the sampling effort has not yet exhausted the return of novel species, as the curve has not yet levelled out as shown in **Appendix G.** Opportunistic sampling was undertaken between quadrats, where additional species were encountered to reconcile this issue and create a complete as species list as possible. There was a high proportion of singleton taxa (only recorded in one quadrat, 40 taxa, 24%) and species only recorded opportunistically (outside quadrats, 50 taxa, 34%). 21 specimens or 13% of the flora could not be confirmed to species level due to inadequate flowering/fruiting/taxonomic uncertainty. Not all of the conservation significant species are in prime flowering in period in Oct (see **Table 8**). There were orchid leaves recorded on stabilised sand dunes ?*Corysanthes, Drakaea* spp. that cannot be ruled out as conservation significant (See **Photo 7**).
Survey effort and extent	Partial Limitation The survey results represent a Phase 1 (primary survey) visit of a Detailed Flora and Vegetation Survey. The 15 Quadrats alone could not be used to capture all of the species diversity within the Project Area, additional opportunistic sampling was conducted to complete a complete as species list as possible. Targeted flora traverses were conducted at more than 50m spacing due to the thick vegetation and time allocation, with the aim being to intersect all potential habitats within the Project Area. There is the possibility for additional flora species, including conservation significant flora species (See discussion) to be found in between the conducted flora traverses (**Figure 4**) as the visibility through dense vegetation was limited. An effective width of 10 m is accepted for many flora in the South West (EPA 2016b), equating to a 5 m search area either side

Potential Limitation	Impact and Discussion
	of the walked transect. Some orchids and smaller herbs are likely to require more intensive searches (EPA 2016b).
Access restrictions within the survey area	Partial Limitation Access to the Project Area was not inhibited, there is the potential for all parts of the Project Areas to be surveyed, ground -truthed or accessed on foot. The Project Area was surveyed on foot at more than 50m wide spacing due to the size of the Project Area vs penetrability through the dense vegetation (thickets/closed heathland) and time constraints. Targeted Flora traverses were not conducted at sufficient spacing to rule out the presence of additional species of conservation significance, such as *Adenanthos* x*cunnninghamii* (P4) other forb species (See Discussion) in between those traverses as shown in **Figure 4**.
Survey timing, rainfall, season of survey	Not a Limitation The EPA (2016b) Guidance recommends the South-West Botanical Province (including Warren IBRA region) botanical surveys be undertaken in Spring (September – November). Supplementary survey is undertaken during secondary peaks in rainfall or the flowering period for additional suites of species and is commonly used to supplement the data collected in the primary survey. Adequate survey may necessitate multiple sampling events in the same season or in different seasons to describe the representative Flora and Vegetation of the Project Area. The survey results represent a Phase 1 (primary survey) visit of a Detailed Flora and Vegetation Survey, conducted in mid Spring. A total of 336mm of rain fell in the three months preceding the survey (July to September) which is 49mm less than the average of 385mm for the same period (BoM 2023). The seasonal conditions can be considered adequate.
Disturbance that may have affected the results of survey (e.g. fire, flood or clearing)	Partial Limitation Fire has recently impacted areas south of the central fire track (2018) and along Sand Patch Road (2021). In these areas, early fire succession impacts the definition of vegetation type patterning and has led to the regrowth of some impenetrable thick heath of Scaevola, Agonis and Acacia, particularly south of the fire track which can impede, walking through the area and the subsequent detection of herbs and cryptic flora. Any possible seedlings of *Adenanthos xcunninghamii* (P4) growing in this area cannot easily be detected.
Other limitations (e.g. Mapping reliability, resources)	Not a Limitation There were no other survey specific limitations.

6 Discussion

A total of 163 species of Flora from 111 Plant Genera and 48 Plant Families were recorded within the 15 Quadrats for the Project Area. Of these, 40 taxa (24%) were from single collections across the quadrats and another 57 taxa (34%) were only recorded from opportunistic collections (outside the quadrats). This reflects the high diversity of herbs/ephemeral forbs and the mosaicking of vegetation units. Twenty-five of the opportunistic species were introduced weed species recorded along Sand Patch Road and/or the central firebreak track.

There were 5 vegetation associations recorded, with one of these vegetation types covering more than 40% of the Project Area, a Low Peppermint Forest/Coastal Heath Mosaic. The vegetation was mapped as a mosaic unit due to the rapid patterning of changes in form and species composition that cannot be differentiated at a meaningful scale. Areas of discrete pure vegetation units were mapped as Coastal Heath, Coastal Limestone Heath and Limestone Mallee. This vegetation patterning is consistent with the previous vegetation surveys of the adjacent Wind Farm area. The ARVS (Sandiford and Barrett, 2010) also reported that the vegetation within the adjacent Wind Farm area is a mosaic of vegetation units. Eco Logical (2020) mapped more than 45% of the 14.33 ha around 15 wind turbines also as a mosaic of Coastal Heath and Peppermint Low Forest. The Limestone Mallee and Limestone Mallee/Coastal Limestone Heath Mosaic is not represented in the ARVS, largely due to the limited relevés that were conducted in that study in this vegetation association.

A species accumulation curve analysis shows that the expected number of species *could be expected* to reach more than 105 taxa after sampling more than 15 quadrats. The sampling effort has not yet exhausted the return of novel species, as shown by the curve not yet levelled out (**Appendix G)**. All of the opportunistic recording of flora outside the quadrats was undertaken to reconcile this issue. When compared to the relevés of the Albany Regional Vegetation Survey (2010), the species richness per quadrat within the Project Area was equivalent or higher.

The recording of opportunistic additional flora species and targeted searches for conservation significant flora was undertaken along transects spaced up to ~50m apart to cover as much of the Project Area as possible and intersect all potential habitat types. Due to the density of the heath/mallee thickets/closed shrubland vegetation there was limited visibility from each transect line from which to detect additional/potentially occurring conservation significant flora species.

Of the 16 desktop identified conservation significant species with suitable habitat within the Project Area, two were detected (2 individuals of *Adenanthos xcunninghamii* (P4) and ~300+ individuals across five populations of *Thomasia quercifolia* (P4), with the presence of the other identified species remaining possible to likely (including *Calectasia cyanea* (T), *Pterostylis heberlei* (P2), *Caladenia evanescens* (P1),

Gyrostemon thesioides (P2), *Thelymitra porphyrosticta (P2), Corysanthes limpida* (P4), *Drosera fimbriata* (P4)) due to the dense heathland and lack of visibility across traverses in the primary survey. There are a number of sterile Orchid species in the central Coastal Heath area within the Project Area that have not been able to be identified (see **Photo 7**). A targeted survey requires one or more site visit/s by an experienced botanist to locate and record details of significant flora individuals and populations, and/or extent of vegetation. Surveys should be undertaken when the targeted flora and/or vegetation are most detectable and identifiable in the field (usually when in flower) (EPA. 2016b). Some of these priority Orchid species flower in winter (August) or late Spring (Nov).

It is noted in particular, that the Threatened Flora species *Calectasia cyanea* is known 500m to the North of the Project Area (2 individuals), within Coastal Limestone Heath (5) /Coastal Heath (3) (Figure 2), so there is suitable habitat throughout the Project Area. There may also be additional individuals of *Adenanthos* x*cunninghamii* (P4) regrowing in the fire impacted are south of the central firebreak track that cannot easily be detected at an immature stage in thick early succession vegetation. This species is likely to occur in the Peppermint Low Forest/Coastal Heath Mosaic along the boundaries with Coastal Heath particularly where Coastal Limestone Tall Shrubland (*Adenanthos sericeus*) meets Coastal Heath (*Adenanthos cuneatus*), the parent species of the P4 hybrid.

7 Conclusions and Recommendations

The quadrat survey entailed a single primary (Phase 1) survey of a Detailed Survey "where adequate survey may necessitate multiple survey attempts in the same or different season" according to the EPA Technical Guide (EPA 2016b).

A total of 163 species of Flora from 111 Plant Genera and 48 Plant Families were recorded within the 15 Quadrats for the Project Area. Of these, 40 taxa (24%) were from single collections across the quadrats and another 57 taxa (34%) were only recorded from opportunistic collections (outside the quadrats). This reflects the high diversity of occasional herbs/ephemeral forbs and the mosaicking of vegetation units. Opportunistic collections were used to compile a complete a species list as possible as the placement of quadrats could not capture this diversity/mosaicking. The recorded vegetation associations and recorded species richness is consistent with other vegetation surveys of the adjacent Wind Farm area (Ecological 2020 and the ARVS, Sandiford and Barrett 2010).

Two Priority flora species were detected (2 individuals of *Adenanthos* x*cunninghamii* (P4) and ~300+ individuals across five populations of *Thomasia quercifolia* (P4) during the Targeted flora traversing across the Project Area.

If the proposed Meteorological Mast development is going to impact areas of the Project Area that were not comprehensively traversed in the primary survey, then infill Targeted flora searches would be recommended to determine any impact to conservation significant species for which the presence remains likely or possible. In many areas of the Project Area the spacing of systematic traversing was >50 m (in dense vegetation with limited visibility), more than the accepted width of 10 m for flora in the Southwest. Some orchids and smaller herbs are also likely to require more intensive searches (EPA 2016b). Additional individuals of *Adenanthos* x*cunninghamii* (P4) may occur in the Peppermint Low Forest/Coastal Heath Mosaic particularly areas in recovery from fire, due to the difficulty of verifying young seedlings at the time of the primary survey.

Twenty-five of the opportunistic species were introduced weed species recorded along Sand Patch Road and/or the central firebreak track. Additional weed density and distribution mapping may also be required to prevent the spread of weeds/ monitor changes to vegetation condition as part of the development proposal. One weed species in particular *Centranthus ?macrosiphon* is of interest to the WA Herbarium as it represents a potential new incursion of the *Centranthus* genus into Western Australia. The presence of this potential new weed species should be monitored for invasiveness.

8 References

Beard, J. S. (1990) 'Plant Life of Western Australia'. Kangaroo Press Pty Ltd. Kenthurst, NSW.

BoM (2022). 'Map of Climate Zones of Australia'. Bureau of Meteorology. Available at http://www.bom.gov.au/climate/how/newproducts/images/zones.shtml (Accessed May 2022).

City of Albany (2019). Environmental Weed Management Plan. Adopted by Council on 26/03/2019 Report Item DIS151.

CALM (1999). *Environmental Weed Strategy for Western Australia*. Department of Conservation and Land Management, Government of Western Australia, Western Australia. Available at: https://www.dpaw.wa.gov.au/images/documents/plants-animals/plants/weeds/environmental_weed_strategy_wa.pdf (Accessed September 2022).

Churchward, H.M, McArthur, W.M., Sewell, P.L. and Bartle, G.A. (1988) *Landforms and Soils of the South Coast and Hinterland, Western Australia, Northcliffe to Manypeaks*. Divisional Report 88/1, CSIRO, Institute of natural Resources and Environment, Division of Water Resources.

DBCA (2022a). Threatened and Priority Flora (TPFL) Database. Custom Search. Prepared by the Species and Communities Program Department of Biodiversity Conservation and Attractions, Government of Western Australia for Terratree Pty Ltd for Detailed Flora Survey in Forrestania. (Accessed September 2022).

DBCA (2022b). WA Herbarium Specimen (WA HERB) Database. Custom search. Prepared by the Species and Communities Program, Department of Biodiversity Conservation and Attractions, Government of Western Australia, for Terratree Pty Ltd for Detailed Flora Survey in Forrestania. (Accessed September 2022).

DBCA (2022c). Department's Threatened Ecological Communities database. Custom search. Prepared by the Species and Communities Program, Department of Biodiversity Conservation and Attractions, Government of Western Australia, for Terratree Pty Ltd for Detailed Flora Survey in Forrestania. (Accessed September 2022).

DCCEW (2023). *Commonwealth (EPBC Act) Protected Matters Search Tool (PMST),* custom database search. Department of Agriculture Water and the Environment (DAWE), Australian Government, Canberra. Available at: https://www.environment.gov.au/epbc/protected-matters-search-tool (Accessed March 2023).

DCCEEW (2021). *Interim Biogeographic Regionalisation for Australia, Version 7*. Department of the Environment and Energy, Australian government. Available at: https://www.environment.gov.au/land/nrs/science/ibra (Accessed Feb 2023).

DPIRD (2018). *Soil-landscape mapping Western Australia – Best Available Soils*. Soil-landscape mapping covering Western Australia at the best available scale (Version April 2018). It is a compilation of various surveys at different scales varying between 1:20,000 and 1:3,000,000. Available at Soil Landscape Mapping - Best Available (DPIRD-027) - Datasets - data.wa.gov.au (Accessed Feb 2023).

DPIRD (2023). *Western Australian Organism List*. Department of Primary Industries and Reginal Development, Government of Western Australia. Available at: https://www.agric.wa.gov.au/organisms (Accessed March 2023).

DWER (2022). Index of Biodiversity Surveys for Assessments (IBSA). Department of Water and Environmental Regulation, Government of Western Australia. Available at: https://biocollect.ala.org.au/ibsa#max%3D20%26sort%3DdateCreatedSort (Accessed May 2022).

Eco Logical Australia (2020). *Flora and Vegetation Survey – Albany Wind Farm.* Memorandum to Synergy.

EPA (2007). *State of the Environment Report: Western Australia*. Environmental Protection Authority, Perth, Western Australia. Available at: http://www.epa.wa.gov.au/state-environment-report-2007 (Accessed September 2022).

EPA (2008). *Environmental Guidance for Planning and Development,* Guidance Statement No. 33. Environmental Protection Authority, Western Australia. Available at: https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-flora-and-vegetation (Accessed September 2022).

EPA (2016a) *Environmental Factor Guideline for Flora and Vegetation.* Environmental Protection Authority, Western Australia. Available at: https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-flora-and-vegetation (Accessed September 2022).

EPA (2016b). *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*. Environmental Protection Authority, Western Australia. Available at: https://www.epa.wa.gov.au/policies-guidance/technical-guidance-flora-and-vegetation-surveys-environmental-impact-assessment (Accessed September 2022).

EPA (2020). Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual: Requirements under the Environmental Protection Act 1986. Available at: https://www.epa.wa.gov.au/procedures-manual (Accessed September 2022).

Hearn, R., Williams, W., Comer, S. 2002. Warren (WAR – Warren). In: *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Available from: https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/warren_p637-655.pdf (Accessed Feb 2023).

Hopper (1979). Biogeographical aspects of speciation in the southwest Australian flora. Annual Review of Ecology and Systematics. 10: 399-422. Available at: https://www.annualreviews.org/doi/10.1146/annurev.es.10.110179.002151 (Accessed September 2023).

IPAC (2017). *Australian Weeds Strategy 2017 to 2027.* Invasive Plants and Animals Committee, Department of Agriculture and Water Resources, Australian Government, Canberra. Available at: https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/pests-diseases-weeds/consultation/aws-final.pdf (Accessed September 2022).

Keighery, B. (1994) 'Bushland plant survey: a guide to plant community survey for the community,' Wildflower Society of Western Australia (Inc.), Nedlands.

McDonald R, Isbell R, Speight J, Walker J. and Hopkins M. (Eds) 1990 Australian Soil and Land Survey Field Handbook, 2nd Edition. Inkata Press, Melbourne.

NVIS TWG (2017) *Australian Vegetation Attribute Manual: National Vegetation Information System,* Version 7.0. National Vegetating Information System Technical Working Group Department of the Environment and Energy, Australian Government, Canberra. Prep by Bolton, M.P., deLacey, C. and Bossard, K.B. (Eds) Available at: https://www.environment.gov.au/land/publications/australian-vegetation-attribute-manual-version-7 (Accessed September 2022).

QGIS Development Team (2023). QGIS Geographic Information System. QGIS Association Project. Available at: http://qgis.osgeo.org.

Sandiford, E.M. and Barrett, S. (2010). *Albany Regional Vegetation Survey, Extent Type and Status*, A project funded by the Western Australian Planning Commission (EnviroPlanning "Integrating NRM into Land Use Planning" and State NRM Program), South Coast Natural Resource Management Inc. and City of Albany for the Department of Environment and Conservation. Unpublished report. Department of Environment and Conservation, Western Australia

Tille, P J. (2006), Soil-landscapes of Western Australia's rangelands and arid interior. Report 313. Department of Agriculture and Food, Western Australia.

WA Herbarium (2023). FloraBase: The Western Australian Flora. Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions, Government of Western Australia. Available at: https://florabase.dpaw.wa.gov.au/ (Accessed Feb 2023).

9 Figures

Figure 1: Project Location map

568000E 570000E 572000E 574000E 576000E 578000E 580000E 582000E

6124000N
6122000N
6120000N
6118000N

Albany Port Rd
ALBANY
Albany Port Rd
Albany Port Rd
Albany Port Rd
Sand Patch Rd

Legend

Sandpatch Meteorological Mast Project Area

Road_Network

Local Road

State Road

Project Location

Project Location

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 1 2 km

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:36383 at A3

Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 1	Review: J. Grehan	
	Revision: Draft	

Terratree

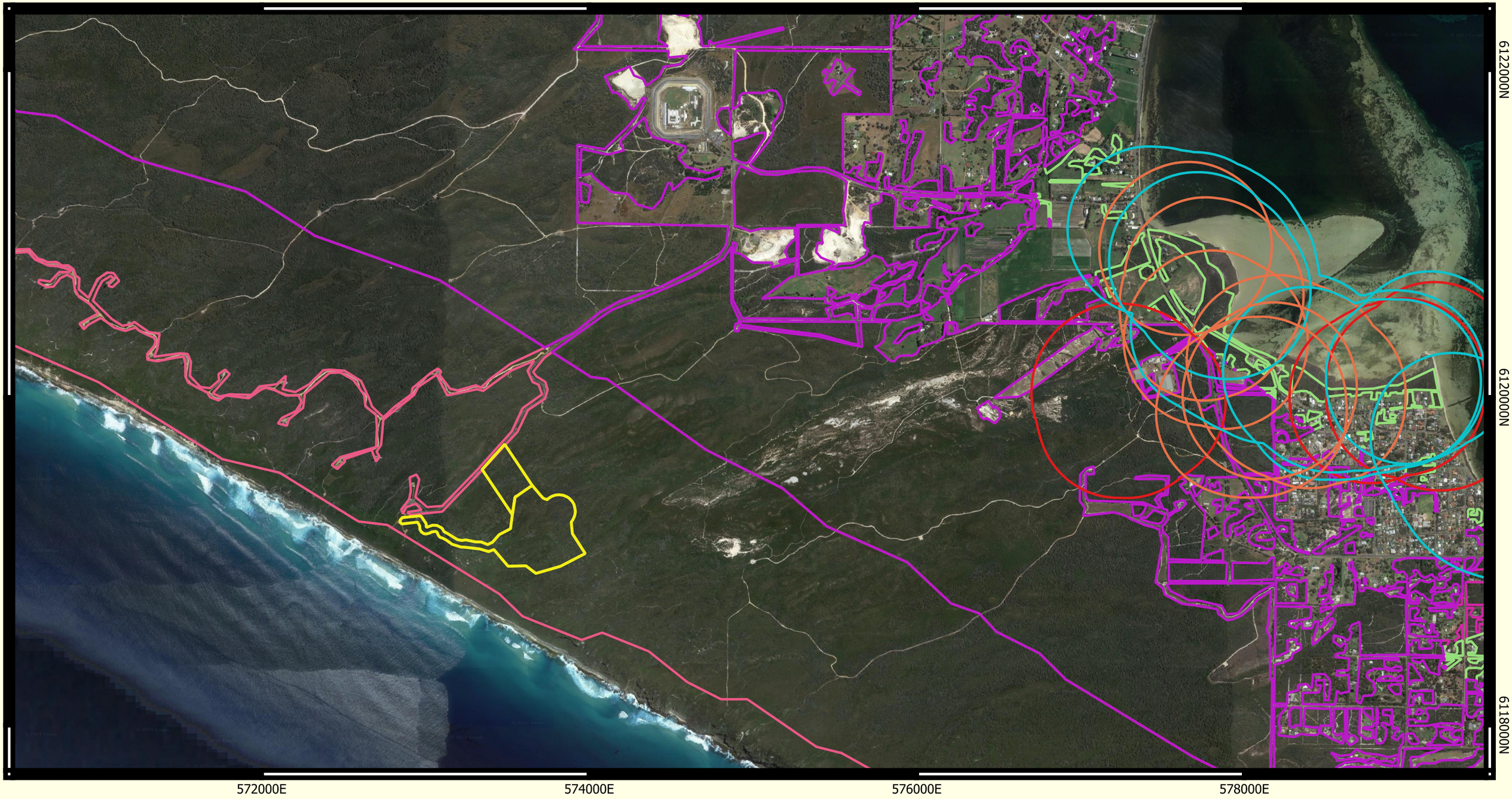
Figure 2: Extant Vegetation

572000E 574000E 576000E 578000E

6122000N

6120000N

6118000N



572000E 574000E 576000E 578000E

Legend

Sandpatch Meteorological Mast Project Area

Priority Ecological Communities

- Banksia littoralis woodland / Melaleuca incana Shrubland
- Coastal Melaleuca incana / Taxandria juniperina Shrubland/Closed Forest
- Subtropical and Temperate Coastal Saltmarsh

BEARD Vegetation Associations

- Torndirrup System 22
- Torndirrup System 49
- Torndirrup System 423

Project Location

Extant Vegetation

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 1 km

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:20921 at A3

Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 2	Review: J. Grehan	
	Revision: Draft	

Terratree

Figure 3: DBCA Recorded Flora Locations

570000E 572000E 574000E 576000E 578000E 580000E

6122000N

6120000N

6118000N

ALBANY

Boronia crassipes

Banksia verticillata

Banksia goodii

Banksia serra

Banksia serra

Calectasia cyanea Calectasia cyanea

Adenanthos x cunninghamii

Calectasia cyanea Calectasia cyanea

Adenanthos x cunninghamii

Thomasia quercifolia

Thomasia quercifolia

Adenanthos x cunninghamii

Adenanthos x cunninghamii

Banksia serra

Adenanthos x cunninghamii

Adenanthos x cunninghamii

Thomasia quercifolia

Thomasia quercifolia

Adenanthos x cunninghamii

Thomasia quercifolia

Thomasia quercifolia

Calectasia cyanea

Adenanthos x cunninghamii

Thomasia quercifolia

Thomasia solanacea

Thomasia quercifolia

Thomasia quercifolia

Adenanthos x cunninghamii

Adenanthos x cunninghamii

Calectasia cyanea

Thomasia quercifolia

Thomasia quercifolia

Adenanthos x cunninghamii

Gahnia sclerioides

Conospermum quadripetalum

Calectasia cyanea

Drosera paleacea

Gahnia sclerioides

Calectasia cyanea

Adenanthos x cunninghamii

Drosera paleacea

Thomasia quercifolia

Thomasia quercifolia

Gahnia sclerioides

Drosera paleacea

Thomasia quercifolia

Drosera paleacea

Drosera paleacea

Isopogon uncinatus

Banksia brownii

Thomasia quercifolia

Isopogon uncinatus

Austrostipa mundula

Adenanthos x cunninghamii

570000E 572000E 574000E 576000E 578000E 580000E

Legend

Sandpatch Meteorological Mast Project Area

TPFL and WAHerb Flora Records

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened Flora

Project Location

DBCA Recorded Flora Locations

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 0.75 1.5 km

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:29887 at A3

Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 3	Review: J. Grehan	Terratree
	Revision: Draft	

Figure 4: Survey Effort Quadrats and Flora Traverses

573000E 573500E 574000E

6119500N

Q14 Q11 Q12 Q13 Q8 Q9 Q10 Q3 Q4 Q15 Q1 Q7 Q2 Q5 Q6

6119000N

573000E 573500E 574000E

Legend

- Sandpatch Meteorological Mast Project Area
- Flora Quadrat 10x10m
- Flora Traverses

Project Location

Survey Effort: Quadrats and Flora Traverses

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 100 200 m

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:3736 at A3

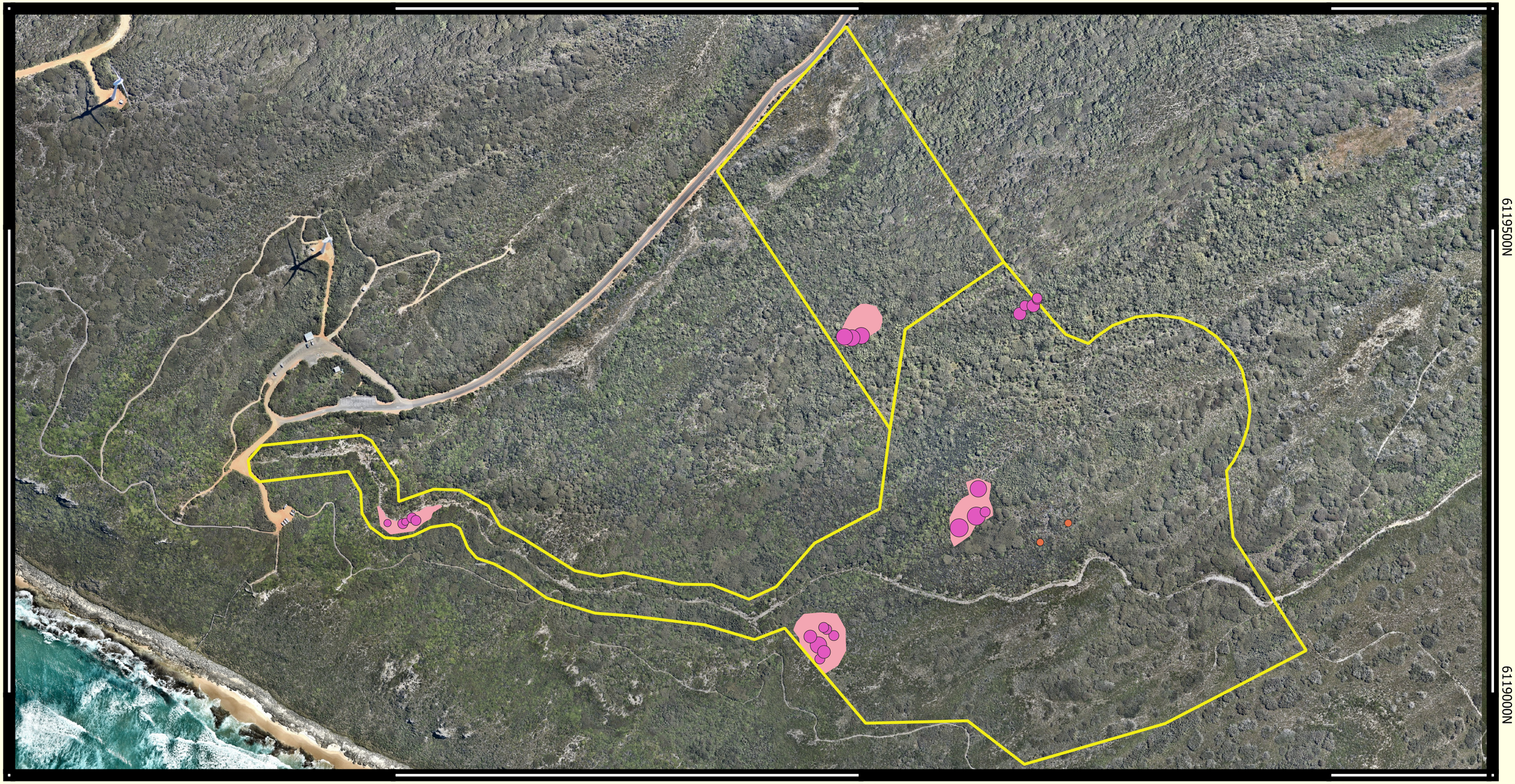
Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 4	Review: J. Grehan	Terratree
	Revision: Draft	

Figure 5: Priority Species Density Map

573000E 573500E 574000E

6119500N

6119000N



573000E 573500E 574000E

Legend

Sandpatch Meteorological Mast Project Area

Vegetation Associations

Coastal Limestone Heath

Thomasia quercifolia (P4)

- Individuals
- 2-5
- 6-10
- 11-20
- 21+

Adenanthos xcunninghamii (P4)

Project Location

Priority Species Density

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 100 200 m

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:3736 at A3

Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 5	Review: J. Grehan	
	Revision: Draft	

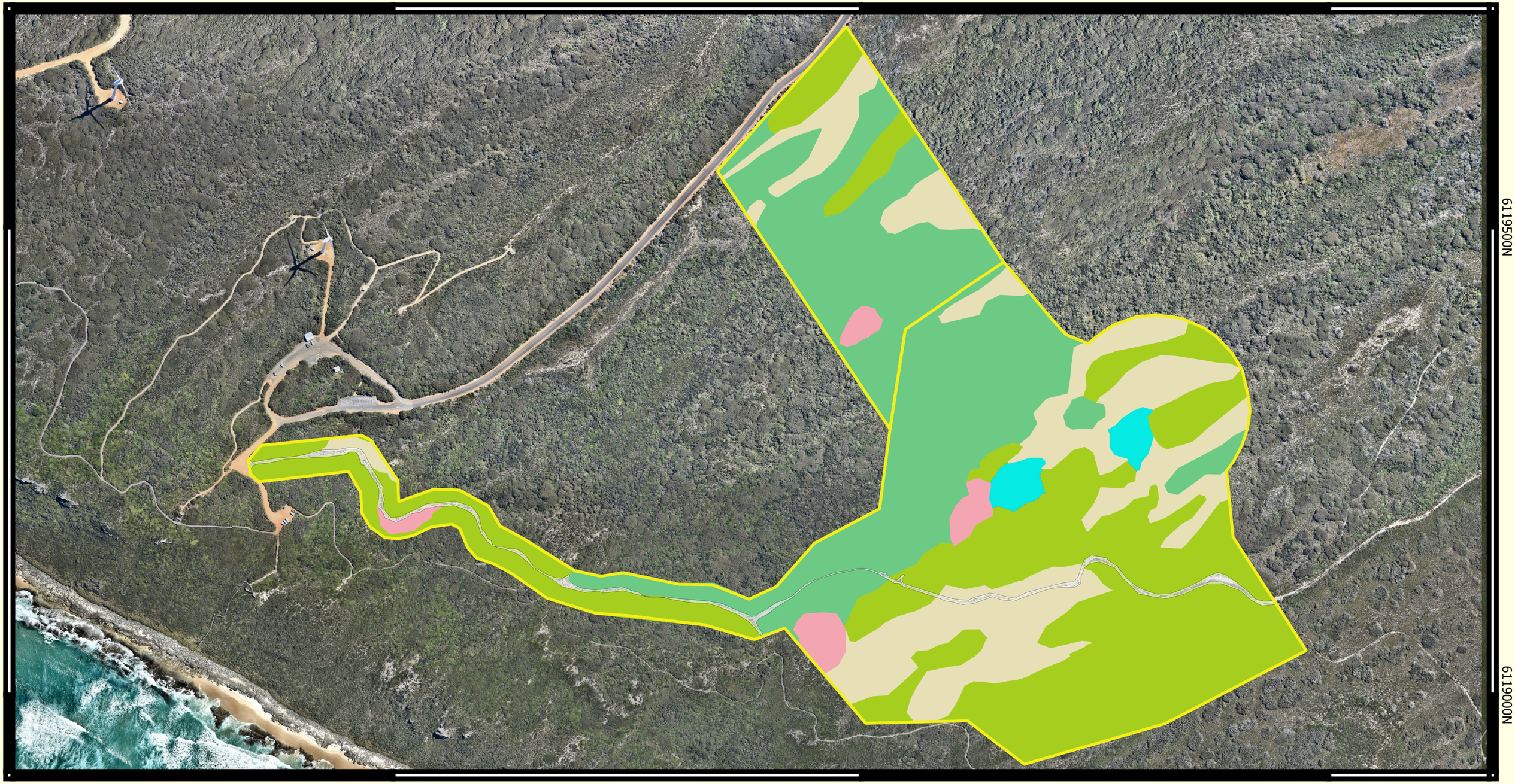
Terratree

Figure 6: Vegetation Associations

573000E 573500E 574000E

6119500N

6119000N



573000E 573500E 574000E

Legend

Sandpatch Meteorological Mast Project Area

Vegetation Associations

- Coastal Heath
- Coastal Limestone Heath
- Peppermint Low Forest/Coastal Heath Mosaic
- Limestone Mallee/Coastal Limestone Heath Mosaic
- Limestone Mallee
- Cleared/Rehabilitation/Track

Project Location

Vegetation Associations

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 100 200 m

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:3736 at A3

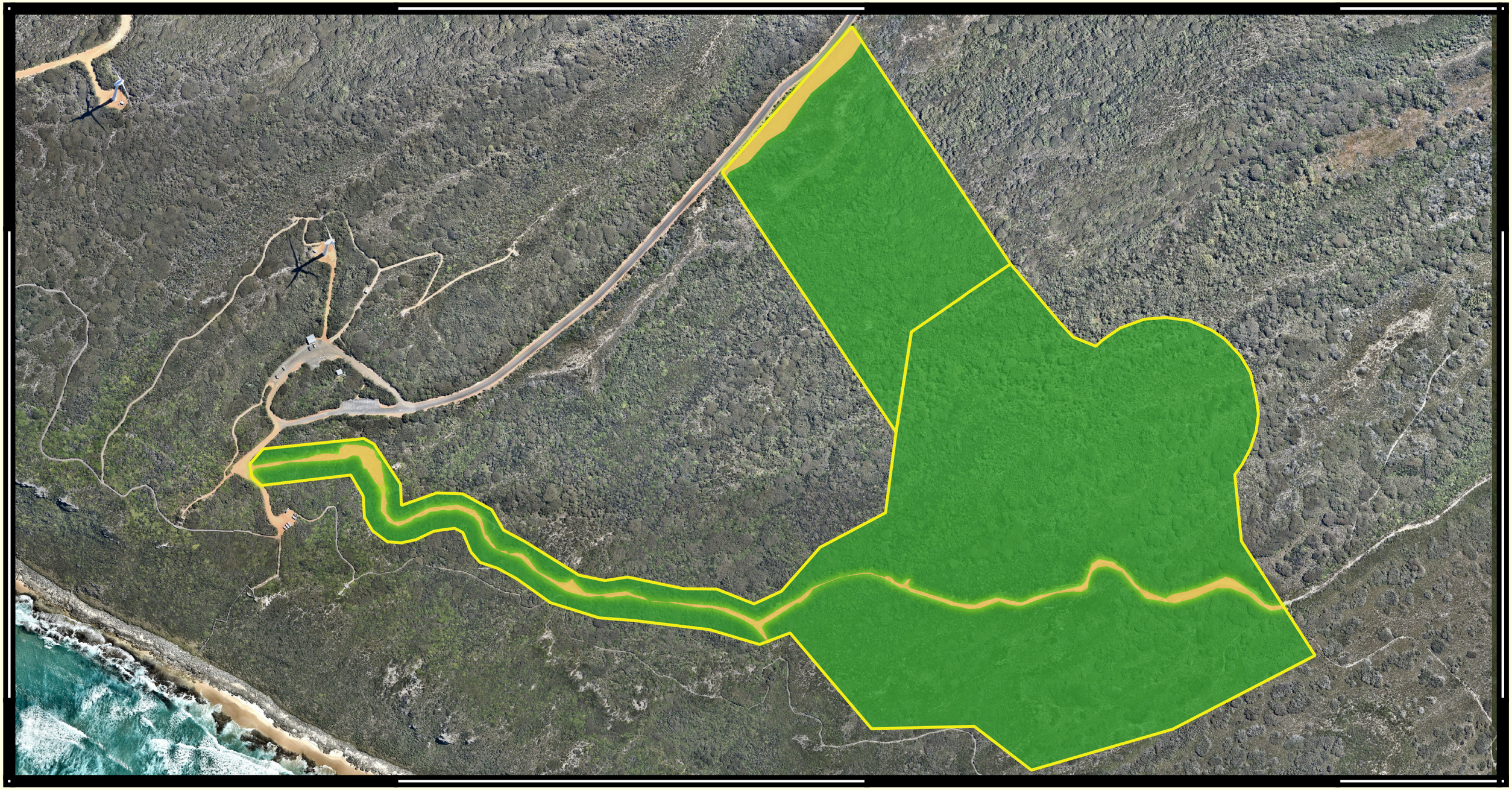
Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 6	Review: J. Grehan	Terratree
	Revision: Draft	

Figure 7: Vegetation Condition

573000E 573500E 574000E

6119500N

6119000N



573000E 573500E 574000E

Legend

Sandpatch Meteorological Mast Project Area

Vegetation Condition

- Excellent
- Very Good

Project Location

Vegetation Condition

Sandpatch Meteorological Mast Flora and Vegetation Survey

0 100 200 m

N

Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:3736 at A3

Prepared for:	SynergyRED	Project #: T22024
Date: 09/03/2023	Prepared: V. Yeomans	
Figure 7	Review: J. Grehan	
	Revision: Draft	

Terratree

10 Appendices

Appendix A: Conservation Codes under WA and Commonwealth Legislation

Table A.1: Conservation Codes for Western Australia Flora and Fauna (DBCA 2019)

Category	Code	Definition
Threatened Species	T: Threatened Species	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria.
	CR: Critically Endangered Species	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
	EN: Endangered Species	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
	VU: Vulnerable Species	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct Species	EX: Extinct Species	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
	EW: Extinct in the Wild Species	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially Protected Species	MI: Migratory Species	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory

Category	Code	Definition
		Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
	CD: Conservation Dependent Fauna	Species of Special Conservation Interest. Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
	OS: Other Specially Protected Species	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Priority Species	Priority 1: Poorly Known Species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g., agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
	Priority 2: Poorly known Species	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
	Priority 3: Poorly-known species	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
	Priority 4: Rare, Near Threatened and Other Species in Need of Monitoring	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Table A.2: Conservation Codes for Western Australia Ecological Communities (DBCA 2019)

Code	Definition
PD: Presumed Totally Destroyed	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B) All occurrences recorded within the last 50 years have since been destroyed.
CR: Critically Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria: A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply: i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply: i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
EN: Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of

Code	Definition
	significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria: A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply: i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B) Current distribution is limited, and one or more of the following apply): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
VU: Vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria: A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.
P1: Priority One	**Poorly-known** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current

Code	Definition
	threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two	**Poorly-known** Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three	**Poorly known** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four	**Adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.** These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five:	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table A.3: Conservation Codes for Threatened Species under the *Commonwealth EPBC Act*

Code	Definition
Ex: Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW: Extinct in the Wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE: Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E: Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
V: Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD: Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table A.4: Conservation Codes for Threatened Ecological Communities under the Commonwealth EPBC Act

Code	Definition
CE: Critically Endangered	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E: Endangered	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
V: Vulnerable	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered nor endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Appendix B: NVIS Structural Formation Terminology (NVIS TWG 2017)

Cover Characteristics								
Foliage cover*		70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover**		>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% Cover***		>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code		d	c	i	r	bi	bc	unknown
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
edge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5,<1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5,<1	closed seagrass bed	seagrassbed	open seagrassbed	sparse seagrassbed	isolated seagrasses	isolated clumps of seagrasses	seagrasses

Notes

The table is based on native vegetation, but can be used in a similar fashion for non-native vegetation and revegetation.

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is obtained by multiplying Crown Cover with Crown type (Hnatiuk *et al*, 2009). It is applied to a stratum in a plot, rather than an individual crown, with the NVIS measure for a vegetation type ideally being a summary of several plots. Foliage Projective Cover, which considers only the vertical projection of photosynthetic components (generally leaves), can be measured by line interception methods for tree, shrub and ground layer vegetation (Specht, R.L and Specht 1999).

** Crown Cover (canopy cover) as per Hnatiuk *et al* (2009). Although relationships between this attribute and Foliage Cover are dependent on season, species, species age etc., the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect method on ground layer, or overstorey vegetative cover. That is, for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

The last column of the table is designed to cater for situations, in existing data, where the cover value for the growth form is unknow

Appendix C: EPBC Protected Matters Search Results

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: 14-Mar-2023

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 Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	66
Listed Migratory Species:	65

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	16
Commonwealth Heritage Places:	None
Listed Marine Species:	91
Whales and Other Cetaceans:	31
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:	24
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	24
Key Ecological Features (Marine):	None
Biologically Important Areas:	13
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
EEZ and Territorial Sea	In buffer area only

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
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area	In buffer area only
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area	In buffer area only

Listed Threatened Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area	In buffer area only
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Dasyornis longirostris Western Bristlebird [515]	Endangered	Species or species habitat likely to occur within area	In feature area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Psophodes nigrogularis nigrogularis Western Heath Whipbird [64449]	Endangered	Species or species habitat may occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche carteri			
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta			
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area
Zanda baudinii listed as Calyptorhynchus baudinii			
Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Breeding known to occur within area	In feature area
Zanda latirostris listed as Calyptorhynchus latirostris			
Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Breeding known to occur within area	In feature area
FISH			
Nannatherina balstoni			
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thunnus maccoyii			
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
INSECT			
Trioza barrettae			
Banksia brownii plant louse [87805]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In feature area
[Parantechinus apicalis](#) Dibbler [313]	Endangered	Species or species habitat known to occur within area	In feature area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area	In feature area
OTHER			
[Westralunio carteri](#) Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
PLANT			
[Banksia brownii](#) Brown's Banksia, Feather-leaved Banksia [8277]	Endangered	Species or species habitat known to occur within area	In feature area
[Banksia goodii](#) Good's Banksia [16727]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Banksia verticillata Granite Banksia, Albany Banksia, River Banksia [8333]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Caladenia granitora [65292]	Endangered	Species or species habitat may occur within area	In buffer area only
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Chordifex abortivus Manypeaks Rush [64868]	Endangered	Species or species habitat known to occur within area	In buffer area only
Conostylis misera Grass Conostylis [21320]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Isopogon uncinatus Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat known to occur within area	In feature area
Kennedia glabrata Northcliffe Kennedia [16452]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Microtis globula South-Coast Mignonette Orchid [6780]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Sphenotoma drummondii](#) Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area	In feature area
[Verticordia fimbrilepis subsp. australis](#) Southern Shy Featherflower [24630]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
REPTILE			
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area
SHARK			
[Carcharias taurus (west coast population)](#) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
[Galeorhinus galeus](#) School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat may occur within area	In buffer area only
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area	In feature area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area	In feature area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phoebetria fusca			
Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche carteri			
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta			
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Marine Species			
Balaenoptera borealis			
Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Balaenoptera edeni			
Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus			
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus			
Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area	In feature area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In feature area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area	In feature area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Mobula birostris as Manta birostris](#) Giant Manta Ray [90034]		Species or species habitat known to occur within area	In feature area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
[Physeter macrocephalus](#) Sperm Whale [59]		Species or species habitat may occur within area	In buffer area only
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Arenaria interpres](#) Ruddy Turnstone [872]		Roosting known to occur within area	In buffer area only
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Roosting known to occur within area	In feature area
[Calidris alba](#) Sanderling [875]		Roosting known to occur within area	In buffer area only
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area	In buffer area only
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area	In buffer area only
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area	In buffer area only
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area	In buffer area only
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area	In feature area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area	In buffer area only
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

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

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - ALBANY TRAINING DEPOT [50137]	WA	In buffer area only
Defence - ALBANY TRAINING DEPOT [50136]	WA	In buffer area only
Defence - ALBANY TRAINING DEPOT ; AIRTC ALBANY [50116]	WA	In buffer area only
Defence - ALBANY TRAINING DEPOT ; AIRTC ALBANY [50115]	WA	In buffer area only
Unknown		
Commonwealth Land - [51398]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51032]	WA	In buffer area only
Commonwealth Land - [51399]	WA	In buffer area only
Commonwealth Land - [52149]	WA	In buffer area only
Commonwealth Land - [51017]	WA	In buffer area only
Commonwealth Land - [51034]	WA	In buffer area only
Commonwealth Land - [51030]	WA	In buffer area only
Commonwealth Land - [50308]	WA	In buffer area only
Commonwealth Land - [51038]	WA	In buffer area only
Commonwealth Land - [51036]	WA	In buffer area only
Commonwealth Land - [51033]	WA	In buffer area only
Commonwealth Land - [51035]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area	In feature area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat may occur within area	In feature area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
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]		Roosting known to occur within area	In feature area
Calidris alba Sanderling [875]		Roosting known to occur within area	In buffer area only
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area overfly marine area	In buffer area only
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area	In buffer area only
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area	In buffer area only
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area	In feature area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area overfly marine area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
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 known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area overfly marine area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In buffer area only
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In feature area
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area overfly marine area	In buffer area only
Pterodroma macroptera Great-winged Petrel [1035]		Breeding known to occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area	In buffer area only
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area overfly marine area	In buffer area only
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Thalasseus bergii as Sterna bergii](#) Greater Crested Tern [83000]		Breeding known to occur within area	In buffer area only
[Thinornis cucullatus as Thinornis rubricollis](#) Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In feature area
[Tringa brevipes as Heteroscelus brevipes](#) Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area	In feature area
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area	In buffer area only
[Xenus cinereus](#) Terek Sandpiper [59300]		Roosting known to occur within area overfly marine area	In buffer area only
Fish			
[Acentronura australe](#) Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In feature area
[Campichthys galei](#) Gale's Pipefish [66191]		Species or species habitat may occur within area	In feature area
[Heraldia nocturna](#) Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area	In feature area
[Hippocampus breviceps](#) Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In feature area
[Histiogamphelus cristatus](#) Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area	In feature area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area	In feature area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area	In feature area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In feature area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area	In feature area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area	In feature area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area	In feature area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In feature area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In feature area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In feature area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In feature area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In feature area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In feature area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area	In feature area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area	In feature area
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Breeding known to occur within area	In feature area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In feature area
Reptile			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area

Whales and Other Cetaceans			[Resource Information]
Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area	In feature area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In feature area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area	In buffer area only
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area	In buffer area only
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area	In buffer area only
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area	In buffer area only
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area	In feature area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area	In buffer area only
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area	In buffer area only
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area	In buffer area only
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area	In buffer area only
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area	In buffer area only
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area	In buffer area only
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area	In buffer area only
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area	In buffer area only
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Bakers Junction	Nature Reserve	WA	In buffer area only
Bon Accord Road	Nature Reserve	WA	In buffer area only
Down Road	Nature Reserve	WA	In buffer area only
Eclipse Island	Nature Reserve	WA	In buffer area only
Gledhow	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Green Island	Nature Reserve	WA	In buffer area only
Gull Rock	National Park	WA	In buffer area only
Lake Powell	Nature Reserve	WA	In buffer area only
Marbelup	Nature Reserve	WA	In buffer area only
Mill Brook	Nature Reserve	WA	In buffer area only
Mistaken Island	Nature Reserve	WA	In buffer area only
NTWA Bushland covenant (0005)	Conservation Covenant	WA	In buffer area only
Phillips Brook	Nature Reserve	WA	In buffer area only
Seal Island (WA32199)	Nature Reserve	WA	In buffer area only
Shelter Island	Nature Reserve	WA	In buffer area only
Torndirrup	National Park	WA	In buffer area only
Unnamed WA01998	Nature Reserve	WA	In buffer area only
Unnamed WA23088	Conservation Park	WA	In buffer area only
Unnamed WA23923	Nature Reserve	WA	In buffer area only
Unnamed WA32478	5(1)(h) Reserve	WA	In buffer area only
Unnamed WA33308	5(1)(h) Reserve	WA	In buffer area only
Unnamed WA44685	5(1)(h) Reserve	WA	In buffer area only
Voyagers Park	5(1)(h) Reserve	WA	In buffer area only
West Cape Howe	National Park	WA	In buffer area only

Nationally Important Wetlands

[Resource Information]

Wetland Name	State	Buffer Status
Oyster Harbour	WA	In buffer area only

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Albany Heritage Park Link Trail, WA	2019/8480	Controlled Action	Assessment Approach	In buffer area only
Albany Heritage Park Trail Network Concept Plan	2017/7943	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Albany Port Authority dredging project	2006/2540	Controlled Action	Post-Approval	In buffer area only
Albany Ring Road Stages 2 and 3B, WA	2020/8769	Controlled Action	Post-Approval	In buffer area only
Bayonet Head Residential Development, Albany, WA	2015/7624	Controlled Action	Further Information Request	In buffer area only
Emu Point Residential Area Project	2010/5479	Controlled Action	Completed	In buffer area only
Southdown Magnetite Mine	2006/2544	Controlled Action	Completed	In buffer area only
Not controlled action				
Albany Motorsport Park, 20kms Northwest Albany, WA	2021/8944	Not Controlled Action	Completed	In buffer area only
Albany Port Maintenance Dredging, Albany, WA	2014/7246	Not Controlled Action	Completed	In buffer area only
Anzac Centre Develpment, Albany, WA	2012/6571	Not Controlled Action	Completed	In buffer area only
Anzac Interpretive Centre Development, Albany, WA	2013/6903	Not Controlled Action	Completed	In buffer area only
Development of Grasmere Wind Farm	2008/4368	Not Controlled Action	Completed	In feature area
Engineered Strand Lumber Plant	2007/3421	Not Controlled Action	Completed	In buffer area only
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Mount Barker to Albany Water Supply Pipeline	2013/6720	Not Controlled Action	Completed	In buffer area only
Prescribed burn of Cells 5, 6 & 8 of Crown Land Reserve 35381, Napier, WA	2013/6798	Not Controlled Action	Completed	In buffer area only
Protected Harbour Development	2006/3091	Not Controlled Action	Completed	In buffer area only
Scuttling of the HMAS Perth	2001/171	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin	2004/1700	Not Controlled Action	Completed	In feature area
South Coast Highway Widening 8.2-14.16 SLK	2017/8009	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Referral decision				
Albany Port Maintenance Dredging	2010/5527	Referral Decision	Completed	In buffer area only

Biologically Important Areas			
Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna carneipes Flesh-footed Shearwater [82404]	Foraging (in high numbers)	Known to occur	In buffer area only
Eudyptula minor Little Penguin [1085]	Foraging (provisioning young)	Known to occur	In feature area
Hydroprogne caspia Caspian Tern [808]	Foraging (provisioning young)	Known to occur	In feature area
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Known to occur	In buffer area only
Onychoprion anaethetus Bridled Tern [82845]	Foraging (in high numbers)	Known to occur	In buffer area only
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur	In buffer area only
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur	In buffer area only

Scientific Name	Behaviour	Presence	Buffer Status
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging (in high numbers)	Known to occur	In buffer area only
Sharks			
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur	In feature area
Whales			
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur	In feature area
Eubalaena australis Southern Right Whale [40]	Calving buffer	Known to occur	In buffer area only
Eubalaena australis Southern Right Whale [40]	Seasonal calving habitat	Known to occur	In feature area
Megaptera novaeangliae Humpback Whale [38]	Migration (north)	Known to occur	In feature area

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.

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix D: Species List from the Detailed Flora and Vegetation Survey 2022

FAMILY	* Denotes Weed Species	*Genus* *Species*
AIZOACEAE		*Carpobrotus virescens*
ANARTHRIACEAE		*Anarthria prolifera*
		Anarthria sp.
		Lyginia imberbis
APIACEAE		*Daucus glochidiatus*
		Platysace compressa
		Xanthosia huegelii
ARALIACEAE		*Hydrocotyle tetragonocarpa*
		Trachymene pilosa
ASPARAGACEAE		*Lomandra* sp.
		Lomandra sp. 1
		Lomandra sp. 2
		Thysanotus patersonii
ASPHODELACEAE	*	*Trachyandra divaricata*
ASTERACEAE	*	*Dittrichia viscosa*
	*	*Hypochaeris glabra*
	*	*Hypochaeris ?radicata*
		Lagenophora huegelii
		Olearia axillaris
		Olearia ciliata
		Pithocarpa cordata
		Podotheca angustifolia
		Podotheca gnaphalioides
		Pseudognaphalium luteoalbum
		Rhodanthe citrina
	*	*Senecio elegans*
		Senecio pinnatifolius var. *latilobus*
		Senecio ramosissimus
	*	*Sonchus oleraceus*
BRASSICACEAE	*	*Heliophila pusilla*
CAMPANULACEAE		*Isotoma scapigera*
CAPRIFOLIACEAE	*	*Centranthus ?macrosiphon* (potential new weed species/range extension)

FAMILY	* Denotes Weed Species	*Genus* *Species*
CARYOPHYLLACEAE	*	*Cerastium glomeratum*
	*	*Silene gallica* var. *gallica*
CASUARINACEAE		*Allocasuarina humilis*
		Allocasuarina lehmanniana subsp. *lehmanniana*
CHENOPODIACEAE		*Rhagodia baccata* subsp. *baccata*
		Threlkeldia diffusa
CRASSULACEAE		*Crassula ?colorata*
CYPERACEAE		*Ammothryon grandiflorum*
		Chaetospora curvifolia
		Chaetospora subbulbosa
		Cyathochaeta sp.
		Gahnia sp. Headland
		Isolepis marginata
		Lepidosperma gladiatum
		Lepidosperma pubisquameum
		Lepidosperma squamatum
		Lepidosperma sp.
		Netrostylis sp. Mt Madden
		Schoenus caespititius
DILLENIACEAE		*Hibbertia cuneiformis*
		Hibbertia cunninghamii
		Hibbertia furfuracea
		Hibbertia grossulariifolia
		Hibbertia racemosa
DROSERACEAE		*Drosera ?erythrogyne*
		Drosera pallida
ERICACEAE		*Acrotriche cordata*
		Leucopogon obovatus subsp. *obovatus*
		Leucopogon obovatus subsp. *revolutus*
		Leucopogon parviflorus
		Leucopogon reflexus
		Lysinema pentapetalum
EUPHORBIACEAE		*Amperea ericoides*

FAMILY	* Denotes Weed Species	*Genus*	*Species*
FABACEAE		*Acacia*	*cochlearis*
		Acacia	*littorea*
		Bossiaea	*?linophylla*
		Bossiaea	*linophylla*
		Chorizema	*glycinifolium*
		Chorizema	*ilicifolium*
		Gompholobium	*confertum*
		Hardenbergia	*comptoniana*
		Isotropis	*cuneifolia* subsp. *cuneifolia*
		Jacksonia	*horrida*
		Kennedia	*coccinea*
		Pultenaea	*tenuifolia*
GERANIACEAE	*	*Geranium*	*molle*
	*	*Pelargonium*	*capitatum*
		Pelargonium	*littorale*
GOODENIACEAE		*?Scaevola*	sp.
		Goodenia	*trinervis*
		Scaevola	*globulifera*
		Scaevola	*nitida*
GYROSTEMONACEAE		*Gyrostemon*	*sheathii*
HAEMODORACEAE		*Conostylis*	*aculeata subsp. aculeata*
IRIDACEAE	*	*?Gladiolus*	sp.
		Patersonia	*occidentalis* var. *occidentalis*
	*	*Romulea*	*rosea* var. *australis*
LAURACEAE		*Cassytha*	*racemosa forma pilosa*
LOGANIACEAE		*Logania*	*fasciculata*
		Logania	*vaginalis*
		Orianthera	*serpyllifolia* subsp. *serpyllifolia*
		Phyllangium	*paradoxum*
MALVACEAE	(P4)	*Thomasia*	*quercifolia*
MONTIACEAE		*Calandrinia*	*brevipedata*

FAMILY	* Denotes Weed Species	*Genus* *Species*
MYRTACEAE		*Agonis flexuosa*
		Eucalyptus angulosa
		Melaleuca pentagona var. *pentagona*
		Melaleuca thymoides
ORCHIDACEAE		*Caladenia applanata* subsp. *applanata*
		Caladenia latifolia
		Corysanthes sp.
		Drakaea sp.
		Microtis media subsp. *media*
		Thelymitra paludosa
OROBANCHACEAE	*	*Orobanche minor*
PAPAVERACEAE	*	*Fumaria muralis* subsp. *muralis*
PHYLLANTHACEAE		*Lysiandra calycina*
PITTOSPORACEAE		*Billardiera fusiformis*
PITTOSPORACEAE		*Billardiera heterophylla*
POACEAE	*	*Aira praecox*
		Austrostipa flavescens
		Austrostipa sp. 1
		Austrostipa sp. 2
		Austrostipa sp. 3
		?Austrostipa sp.
		Avena barbata
	*	*Briza maxima*
	*	*Briza minor*
	*	*Bromus diandrus*
		?Eragrostis sp.
		?Eriachne sp.
	*	*Ehrharta longiflora*
	*	*Lagurus ovatus*
		Poa drummondiana
		Poa poiformis
		Poa ?porphyroclados
		Rytidosperma caespitosum
	*	*Vulpia myuros*

FAMILY	* Denotes Weed Species	*Genus*	*Species*
POLYGALACEAE		*Comesperma*	*confertum*
PRIMULACEAE	*	*Lysimachia*	*arvensis*
PROTEACEAE		*Adenanthos*	*cuneatus*
		Adenanthos	*sericeus* subsp. *sericeus*
	(P4)	*Adenanthos*	x*cunninghamii*
		Banksia	*dallanneyi* subsp. *dallanneyi* var. *dallanneyi*
		Banksia	*ilicifolia*
		Banksia	*praemorsa*
		Banksia	*sessilis*
		Hakea	*?sulcata*
		Hakea	*linearis*
		Hakea	*oleifolia*
		Hakea	*prostrata*
		Hakea	*ruscifolia*
		Hakea	sp.
		Isopogon	*formosus* subsp. *formosus*
RANUNCULACEAE		*Clematis*	*pubescens*
RESTIONACEAE		*Cyathochaeta*	sp.
		Desmocladus	*flexuosus*
RHAMNACEAE		*Spyridium*	*globulosum*
		Spyridium	*majoranifolium*
		Trymalium	*ledifolium* var. *rosmarinifolium*
RUBIACEAE		*Opercularia*	*hispidula*
		Opercularia	*vaginata*
SANTALACEAE		*Exocarpos*	*sparteus*
		Leptomeria	*pauciflora*
SCROPHULARIACEAE	*	*Dischisma*	*arenarium*
		Myoporum	*oppositifolium*
SOLANACEAE		*Anthocercis*	*littorea*
STYLIDIACEAE		*Stylidium*	*fasciculatum*
		Stylidium	*violaceum*

FAMILY	* Denotes Weed Species	*Genus*	*Species*
THYMELAEACEAE		*Pimelea ferruginea*	
		Pimelea rosea var. *rosea*	

Appendix E: Quadrat Data and Vegetation Descriptions

T22024 Site: Q1 Vegetation Unit: Limestone Mallee/Coastal Heath Mosaic
Described by: Vanessa Yeomans **Date:** 11/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Swale at bottom of steep slope
Latitude: -35.0675399 **Longitude:** 117.8061018
Habitat: Lower slope, 0% Bare Ground, 20% Leaf Litter
Soil: Grey fine sand
Rock Type: None

Vegetation: Low Open Forest of *Agonis flexuosa* over tall open shrubland of *Adenanthos sericeus, Spyridium globulosum* and *Bossiaea linophylla* over sedgeland of *Lepidosperma gladiatum* on grey sand of a dune swale.

Vegetation Condition: Excellent. No weeds.

Fire Age: >5

Q1 Species	Height (m)	Form	% Cover	Dominant /Notes
Agonis flexuosa	5	Tree	60	yes
Lepidosperma gladiatum	1.5	Sedge	45	yes
Adenanthos sericeus subsp. *sericeus*	4	Shrub >2m	15	yes
Spyridium globulosum	3	Shrub >2m	5	yes
Bossiaea linophylla	1.8	Shrub 1-2m	2	yes
Acacia littorea	1.5	Shrub 1-2m	1	yes
Lepidosperma squamatum	0.8	Sedge	1	yes
Leucopogon obovatus subsp. *revolutus*	1.8	Shrub 1-2m	1	
Rhagodia baccata subsp. *baccata*	1.5	Shrub 1-2m	1	

Q1 Species	Height (m)	Form	% Cover	Dominant /Notes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.2	Shrub 1-2m	0.1	
Anarthria prolifera	0.6	Forb	0.1	yes
Billardiera heterophylla	0.4	Shrub	0.1	
Cassytha racemosa forma *pilosa*	-	Forb	0.1	
Clematis pubescens	5	Creeper	0.1	yes
Desmocladus flexuosus	1.5	Sedge	0.1	
Olearia axillaris	1	Shrub 1-2m	0.1	
Opercularia hispidula	0.2	Forb	0.1	

T22024 Site: Q2 **Vegetation Unit:** Coastal Heath
Described by: Vanessa Yeomans **Date:** 11/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Top of Dune
Latitude: -35.0681002 **Longitude:** 117.8070983
Landscape: Steep slope, 2% Bare Ground, 20% Leaf Litter
Soil: Grey fine sand
Rock Type: None

Vegetation: Tall open shrubland of *Adenanthos sericeus subsp. sericeus* over open mid heathland of *Allocasuarina lehmanniana* subsp. *lehmanniana, Leucopogon reflexus*, *Olearia axillaris, Spyridium globulosum*, *Acacia littorea* and *Bossiaea linophylla* over open sedgeland of *Desmocladus flexuosus* and *Lepidosperma squamatum* on fine grey sand of a steep dune slope.

Vegetation Condition: Excellent. Signs of animal diggings.

Fire Age: >5

Q2 Species	Height (m)	Form	% Cover	Dominant /Notes
Adenanthos sericeus subsp. *sericeus*	2	Shrub	25	yes
Desmocladus flexuosus	0.3	Sedge	25	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.2	Shrub	10	yes
Leucopogon reflexus	1.5	Shrub	10	yes
Acacia littorea	1.2	Shrub	5	yes
Lepidosperma squamatum	0.4	Sedge	5	yes
Olearia axillaris	1.5	Shrub	5	yes
Spyridium globulosum	1.5	Shrub	5	yes
Bossiaea linophylla	1.8	Shrub	2	yes
Pimelea rosea subsp. *rosea*	0.5	Shrub	0.5	
Ammothryon grandiflorum	0.2	Forb	0.1	

Q2 Species	Height (m)	Form	% Cover	Dominant /Notes
Anthocercis littorea	3	Shrub	0.1	
Banksia dallanneyi	0.5	Shrub	0.1	
Clematis pubescens	5	Shrub	0.1	
Conostylis aculeata subsp. *aculeata*	0.5	Heb	0.1	
Hibbertia racemosa	0.75	Shrub	0.1	
Lomandra sp.	-	Herb	0.1	
Lysiandra calycina	1	Shrub	0.1	
Melaleuca thymoides	2	Shrub	0.1	
Opercularia vaginata	0.4	Herb	0.1	
Orianthera serpyllifolia subsp. *serpyllifolia*	-	Forb	0.1	
Platysace compressa	1	Herb	0.1	
Poa ?porphyroclados	1	Herb	0.1	
Poa poiformis	0.9	Herb	0.1	
Rhodanthe citrina	0.3	Herb	0.1	
Schoenus caespititius	0.8	Sedge	0.1	
Thelymitra paludosa	0.75	Herb	0.1	
Acrotriche cordata	0.6	Shrub	Opp	
Cassytha racemosa forma *pilosa*	1	Herb/ Climber	Opp	
Exocarpos sparteus	4	Shrub	Opp	
Goodenia trinervis	1	Shrub	Opp	
Gyrostemon sheathii	2	Shrub	Opp	
Hakea linearis	4	Shrub	Opp	
Hibbertia cunninghamii	0.7	Shrub	Opp	
Isotropis cuneifolia subsp. *cuneifolia*	0.3	Shrub	Opp	
Leucopogon parviflorus	3	Shrub	Opp	
Lysinema pentapetalum	0.2	Shrub	Opp	
Patersonia occidentalis var. *occidentalis*	1	Herb	Opp	
Pimelea ferruginea	1.5	Shrub	Opp	

Q2 Species	Height (m)	Form	% Cover	Dominant /Notes
Pithocarpa cordata	2	Shrub	Opp	
Spyridium majoranifolium	1.6	Shrub	Opp	
Stylidium fasciculatum	0.6	Herb	Opp	

T22024 Site: Q3 Vegetation Unit: Limestone Mallee
Described by: Vanessa Yeomans **Date:** 12/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** South side of crest dune
Latitude: -35.0670525 **Longitude:** 117.8079498
Habitat: Lower slope, 0% bare ground, 35% leaf litter
Soil: Brown, sandy loam. Deep leaf litter
Rock Type: None

Vegetation: Open mallee forest of *Eucalyptus angulosa* with *Agonis flexuosa* over tall sparse shrubland of *Spyridium globulosum* over mid heathland of *Hibbertia furfuracea*, *Leucopogon obovatus* subsp. *revolutus* and *Bossiaea linophylla* with climbing *Clematis pubescens* over sparse sedgeland of *Lepidosperma squamatum* and *Desmocladus flexuosus* on brown sandy loam with deep leaf litter on southern side of dune slope.

Vegetation Condition: Excellent

Fire Age: >5

Q3 Species	Height (m)	Form	% Cover	Dominant /Notes
Eucalyptus angulosa	6	Tree/Tree	65	yes
Hibbertia furfuracea	1.5	Shrub	35	yes
Leucopogon obovatus subsp. *revolutus*	2	Shrub	20	yes
Lepidosperma squamatum	0.6	Sedge	15	yes
Agonis flexuosa	5	Tree/Tree	10	yes
Bossiaea linophylla	2	Shrub	10	yes

Q3 Species	Height (m)	Form	% Cover	Dominant /Notes
Spyridium globulosum	3	Shrub	5	yes
Acacia littorea	1.5	Shrub	2	
Clematis pubescens	2	Creeper	2	yes
Desmocladus flexuosus	0.3	Sedge	2	yes
Olearia axillaris	1.5	Shrub	2	
Anarthria prolifera	1	Sedge	1	
Hardenbergia comptoniana	3	Creeper	1	
Opercularia hispidula	0.5	Forb	0.5	

T22024 Site: Q4 **Vegetation Unit:** Peppermint Low Forest/Coastal Heath
Described by: Vanessa Yeomans **Date:** 12/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Saddle between dunes
Latitude: -35.0672337 **Longitude:** 117.8088297
Habitat: Gentle slope, 5% Bare Ground, 25% Leaf Litter
Soil: Grey fine sand
Rock Type: None

Vegetation: Heathland of *Allocasuarina humilis, Bossiaea linophylla, Jacksonia horrida, Leucopogon obovatus* subsp. *revolutus* and *Hibbertia furfuracea* over low sparse shrubland of *Lysinema pentapetalum* and *Leucopogon reflexus* over open sedgeland of *Anarthria prolifera, Schoenus caespititius* and *Lepidosperma squamatum* with isolated forbs of *Hibbertia racemosa* and *Lagenophora huegelii* on fine grey sand of a gentle slope of an interdunal saddle.

Vegetation Condition: Excellent. Animal droppings, and large numbers of sticky ant hills present.

Fire Age: >5

Q4 Species	Height (m)	Form	% Cover	Dominant /Notes
Anarthria prolifera	0.3	Sedge	35	yes
Allocasuarina humilis	1	Shrub 1-2m	25	yes
Bossiaea linophylla	1.5	Shrub 1-2m	25	yes
Jacksonia horrida	1	Shrub 1-2m	10	yes
Leucopogon obovatus subsp. *revolutus*	1.2	Shrub 1-2m	10	yes
Schoenus caespititius	0.8	Sedge	10	yes
Hibbertia furfuracea	1.2	Shrub 1-2m	5	yes
Acacia littorea	1	Shrub 0.5-1m	2	
Adenanthos cuneatus	1.5	Shrub 1-2m	2	yes
Goodenia trinervis	0.3	Forb	2	

Q4 Species	Height (m)	Form	% Cover	Dominant /Notes
Hibbertia racemosa	0.3	Forb	2	yes
Lepidosperma squamatum	0.8	Sedge	2	yes
Lysinema pentapetalum	0.6	Shrub 0.5-1m	2	yes
Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*	0.3	Shrub <0.5m	1	
Banksia sessilis	1.5	Shrub 1-2m	1	
Gyrostemon sheathii	0.8	Shrub 0.5-1m	1	
Hakea ruscifolia	0.2	Creeper	1	
Lagenophora huegelii	0.2	Forb	1	yes
Leucopogon obovatus subsp. *obovatus*	1	Shrub 1-2m	1	
Leucopogon reflexus	0.5	Shrub 0.5-1m	1	yes
Melaleuca thymoides	0.8	Shrub 0.5-1m	1	
Olearia axillaris	1.5	Shrub 1-2m	1	
Opercularia hispidula	0.3	Forb	1	
Platysace compressa	0.6	Forb	1	
Spyridium globulosum	2	Shrub 1-2m	1	yes
Xanthosia huegelii	0.2	Forb	0.50	
Billardiera fusiformis	2	Creeper	0.25	
Hakea linearis	1	Shrub 0.5-1m	0.25	
Pimelea rosea subsp. *rosea*	0.25	Shrub <0.5m	0.25	
Olearia ciliata	0.3	Forb	0.1	
Adenanthos sericeus subsp. *sericeus*	5	Shrub	Opp	
***Adenanthos xcunninghamii* (P4)**	3	Shrub	Opp	
Agonis flexuosa	10	Tree	Opp	
Chorizema glycinifolium	0.2	Forb	Opp	
Eucalyptus angulosa	5	Mallee	Opp	
Hakea sp.	1	Shrub	Opp	

Q4 Species	Height (m)	Form	% Cover	Dominant /Notes
Scaevola nitida	3	Shrub	Opp	
Stylidium fasciculatum	0.6	Herb	Opp	

T22024 Site: Q5 Vegetation Unit: Coastal Heath
Described by: Vanessa Yeomans **Date:** 12/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Crest of Dune
Latitude: -35.0681162 **Longitude:** 117.8084227
Habitat: Crest, 5% Bare Ground, 25% Leaf Litter
Soil: White, grey fine sand
Rock Type: Nil

Vegetation: Sparse mid shrubland of *Anthocercis littorea, Adenanthos sericeus* subsp. *sericeus* over low heathland of *Acrotriche cordata, Acacia cochlearis, Spyridium majoranifolium* and *Trymalium ledifolium* var. *rosmarinifolium* over low open heathland of *Pimelea ferruginea* and *Platysace compressa* over open sedgeland of *Lepidosperma squamatum* and *Desmocladus flexuosus* with isolated forbs of *Hibbertia racemosa* and *Conostylis aculeata* subsp. *aculeata* on white grey fine sand of a dune crest (in recovery from 2018 fire).

Vegetation Condition: Excellent. Fire recovery

Fire Age: <5

Q5 Species	Height (m)	Form	% Cover	Dominant /Notes
Acacia littorea	0.8	Shrub 0.5-1m	35	yes
Lepidosperma squamatum	0.3	Sedge	20	yes
Bossiaea linophylla	0.8	Shrub 0.5-1m	2	yes
Acrotriche cordata	0.8	Shrub 0.5-1m	15	yes
Desmocladus flexuosus	0.25	Sedge	15	yes
Pimelea ferruginea	0.3	Shrub <0.5m	15	yes
Spyridium majoranifolium	0.6	Shrub 0.5-1m	15	yes
Acacia cochlearis	0.8	Shrub 0.5-1m	10	yes
Anthocercis littorea	1.2	Shrub 1-2m	10	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.2	Shrub	1	
Conostylis aculeata subsp. *aculeata*	0.25	Forb	1	yes

Q5 Species	Height (m)	Form	% Cover	Dominant /Notes
Exocarpos sparteus	1.5	Shrub 1-2m	1	
Gyrostemon sheathii	0.8	Shrub 0.5-1m	1	yes
Hakea linearis	0.8	Shrub 0.5-1m	1	
Olax phyllanthi	0.6	Shrub 0.5-1m	1	
Olearia axillaris	0.5	Shrub 0.5-1m	1	
Scaevola nitida	0.8	Shrub 0.5-1m	1	
Scaevola sp.?	0.3	Shrub <0.5m	1	
Spyridium globulosum	0.8	Shrub 0.5-1m	1	
Gahnia sp. Headland	0.3	Sedge	0.5	
Banksia sessilis	0.5	Shrub 0.5-1m	0.25	
Lysiandra calycina	0.3	Shrub <0.5m	0.25	
Senecio pinnatifolius var. *latilobus*	0.3	Forb	0.25	
Opercularia hispidula	0.3	Forb	0.2	
Amperea ericoides	0.4	Herb	Opp	
Gyrostemon sheathii	2	Shrub	Opp	
Hibbertia grossulariifolia	0.1	Shrub <0.5m	Opp	
Jacksonia horrida	2.5	Shrub <0.5m	Opp	
Logania vaginalis	2.5	Shrub	Opp	
Lysinema pentapetalum	0.5	Shrub	Opp	
Orianthera serpyllifolia subsp. *serpyllifolia*	0.2	Forb	Opp	

T22024 Site: Q6 Vegetation Unit: Peppermint Low Forest/Coastal Heath Mosaic
Described by: Vanessa Yeomans **Date:** 12/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Dune Swale/Lower Slope
Latitude: -35.0689734 **Longitude:** 117.8073863
Habitat: Lower Slope, Swale, 10% Bare Ground 5% Leaf Litter
Soil: Grey fine sand
Rock Type: Nil

Vegetation: Low open mallee woodland of *Agonis flexuosa* over closed mid heathland of *Scaevola nitida, Acacia littorea, Bossiaea linophylla, Banksia sessilis* and *Gyrostemon sheathii* over low open shrubland of *Pimelea rosea* subsp. *rosea* and *Leucopogon reflexus* over isolated clumps of sedges of *Lepidosperma gladiatum* on fine grey sand of a lower slope/dune swale (in recovery from 2018 fire).

Vegetation Condition: Excellent. Regeneration for Fire in 2018. Very Thick Vegetation.

Fire Age: <5

Q6 Species	Height (m)	Form	% Cover	Dominant /Notes
Scaevola nitida	3	Shrub>2m	45	yes
Agonis flexuosa	3	Tree	35	yes
Acacia littorea	1.8	Shrub 1-2m	25	yes
Bossiaea linophylla	1.5	Shrub 1-2m	15	yes
Pimelea rosea subsp. *rosea*	0.8	Shrub 0.5-1m	10	yes
Leucopogon reflexus	0.8	Shrub 0.5-1m	1	
Allocasuarina humilis	0.6	Shrub 0.5-1m	5	
Banksia sessilis	1.5	Shrub 1-2m	5	yes
Gyrostemon sheathii	1.5	Shrub 1-2m	5	yes
Leucopogon obovatus subsp. *obovatus*	2.5m	Shrub <2.5	0.1	

Q6 Species	Height (m)	Form	% Cover	Dominant /Notes
Leucopogon parviflorus	3	Shrub>2m	0.1	
Opercularia hispidula	1	Herb	0.1	
Pelargonium littorale	0.5	Herb	0.1	
Spyridium globulosum	5	Shrub>2m	0.1	
Spyridium majoranifolium	1.6	Shrub 1-2m	0.1	
Caladenia applanata subsp. a*pplanata*	0.5	Herb	Opp	
Drakea sp.	0.1	Herb	Opp	

T22024 Site: Q7 **Vegetation Unit:** Limestone Coastal Heath
Described by: Vanessa Yeomans **Date:** 13/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Start of small ridge to North-East
Latitude: -35.0674442 **Longitude:** 117.8072867
Habitat: Dune, steep slope, crest, 10% Bare Ground 15% Leaf Litter
Soil: Grey fine sand
Rock Type: Nil

Vegetation: Tall sparse shrubland of *Adenanthos sericeus* subsp. *sericeus* over mid open shrubland of *Spyridium globulosum, Allocasuarina lehmanniana* subsp. *lehmanniana, Leucopogon parviflorus* and *Scaevola nitida* over low shrubland of *Thomasia quercifolia, Acacia littorea, Acrotriche cordata* and *Leucopogon obovatus* subsp. *revolutus* over open sedgeland of *Desmocladus flexuosus* and sparse forbs of *Opercularia vaginata* and *Conostylis aculeata* subsp. *aculeata* on fine grey sand of a dune crest.

Vegetation Condition: Excellent. Animal Tracks.

Fire Age: >5

Q7 Species	Height (m)	Form	% Cover	Dominant /Notes
***Thomasia quercifolia* (P4)**	0.4	Shrub <0.5m	35	yes
Desmocladus flexuosus	0.4	Sedge	30	yes
Spyridium globulosum	1.5	Shrub 1-2m	25	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.2	Shrub 1-2m	10	yes
Adenanthos sericeus subsp. *sericeus*	2	Shrub>2m	8	yes
Acacia littorea	0.8	Shrub 0.5-1m	5	yes
Acrotriche cordata	0.8	Shrub 0.5-1m	5	yes
Leucopogon parviflorus	1.2	Shrub 1-2m	5	yes
Hibbertia grossulariifolia	0.2	Creeper	2	

Q7 Species	Height (m)	Form	% Cover	Dominant /Notes
Opercularia vaginata	0.3	Forb	2	yes
Scaevola nitida	1.8	Shrub 1-2m	2	yes
Banksia sessilis	0.8	Shrub 0.5-1m	1	
Bossiaea linophylla	1.2	Shrub 1-2m	1	
Conostylis aculeata subsp. *aculeata*	0.25	Herb	1	yes
Lepidosperma gladiatum	1.5	Sedge	1	
Leucopogon obovatus subsp. *revolutus*	0.8	Shrub 0.5-1m	1	yes
Logania vaginalis	0.6	Shrub 0.5-1m	1	
Pimelea ferruginea	0.5	Shrub <0.5m	1	yes
Platysace compressa	0.4	Shrub <0.5m	1	yes
Trymalium ledifolium var. *rosmarinifolium*	0.4	Shrub <0.5m	1	
Clematis pubescens	1	Creeper	0.5	
Lysiandra calycina	0.5	Shrub <0.5m	0.5	
Opercularia hispidula	0.4	Forb	0.5	
Stylidium fasciculatum	0.2	Forb	0.5	
Phyllangium paradoxum	0.2	Forb	0.4	
Olearia axillaris	0.5	Shrub 0.5-1m	0.2	
Thysanotus patersonii	0.5	Herb	0.2	
Acrotriche cordata	0.6	Shrub 0.5-1m	0.1	
Austrostipa sp. 1	0.3	Grass	0.1	
Austrostipa sp. 2	0.3	Grass	0.1	
Chorizema ilicifolium	0.3	Shrub <0.5m	0.1	
Comesperma confertum	1.2	Shrub 1-2m	0.1	
Gahnia sp. Headland	0.2	Sedge	0.1	

Q7 Species	Height (m)	Form	% Cover	Dominant /Notes
Hibbertia cuneiformis	3	Shrub >2m	0.1	
Isotropis cuneifolia subsp. *cuneifolia*	0.2	Forb	0.1	
Lagenophora huegelii	0.2	Forb	0.1	
Netrostylis sp. Mt Madden	0.3	Sedge	0.1	
Poa poiformis	0.3	Grass	0.1	
Spyridium globulosum	2	Shrub 1-2m	0.1	
Leptomeria pauciflora	2	Shrub 1-2m	Opp	

T22024 Site: Q8 Vegetation Unit: Limestone Mallee/Coastal Limestone Heath Mosaic
Described by: Vanessa Yeomans **Date:** 13/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Upper Dune Slope/Swale
Latitude: -35.0662869 **Longitude:** 117.8086511
Habitat: Undulating, 0% Bare Ground 65% Leaf Litter
Soil: Grey/ pale brown fine sand
Rock Type: Nil

Vegetation: Open mallee forest of *Eucalyptus angulosa* over open tall shrubland of *Bossiaea linophylla* and *Adenanthos sericeus* subsp. *sericeus* with *Clematis pubescens* creepers over sparse mid shrubland of *Hibbertia furfuracea* and *Leucopogon obovatus* subsp. *revolutus* over sedgeland of *Desmocladus flexuosus* and *Gahnia* sp. Headland on grey fine sand of upper dune slopes.

Vegetation Condition: Excellent.

Fire Age: >5

Q8 Species	Height (m)	Form	% Cover	Dominant /Notes
Eucalyptus angulosa	8	Tree Mallee	75	yes
Gahnia sp. Headland	0.4	Sedge	5	yes
Hibbertia furfuracea	2	Shrub 1-2m	5	yes
Desmocladus flexuosus	0.3	Sedge	45	yes
Clematis pubescens	2	Creeper	2	yes
Adenanthos sericeus subsp. *sericeus*	3	Shrub>2m	10	yes
Bossiaea linophylla	2.5	Shrub>2m	10	yes
Leucopogon obovatus subsp. *revolutus*	2	Shrub 1-2m	10	yes
Acacia littorea	1.2	Shrub 1-2m	1	
Adenanthos cuneatus	1.2	Shrub 1-2m	1	
Anarthria prolifera	0.3	Sedge	1	

Q8 Species	Height (m)	Form	% Cover	Dominant /Notes
Leucopogon parviflorus	1.8	Shrub 1-2m	1	
Opercularia hispidula	0.5	Forb	1	
Patersonia occidentalis var. *occidentalis*	1	Herb	1	
Platysace compressa	0.6	Shrub 0.5-1m	1	
Spyridium globulosum	2	Shrub 1-2m	1	
Lysiandra calycina	0.6	Shrub 0.5-1m	0.25	
Trymalium ledifolium var. *rosmarinifolium*	0.6	Shrub 0.5-1m	0.25	
Senecio pinnatifolius var. *latilobus*	0.3	Forb	0.2	
Austrostipa sp. 2	0.8	Grass	0.1	
Austrostipa sp. 3	0.3	Grass	0.1	
Drosera ?erythrogyne	0.3	Forb	0.1	

T22024 Site: Q9 Vegetation Unit: Peppermint Low Forest/ Coastal Heath Mosaic
Described by: Vanessa Yeomans **Date:** 13/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** High ridge running East-West
Latitude: -35.0661485 **Longitude:** 117.8101021
Habitat: Dune, upper steep Slope, 5% Bare Ground 25% Leaf Litter
Soil: Grey fine sand
Rock Type: Nil

Vegetation: Mallee woodland of *Agonis flexuosa* with Isolated *Eucalyptus angulosa,* over isolated tall shrubs of *Adenanthos sericeus* subsp. *sericeus* over sparse mid shrubland of *Bossiaea linophylla*, *Leucopogon obovatus* subsp. *revolutus* and *Banksia sessilis* over sparse low shrubland of *Adenanthos cuneatus, Melaleuca thymoides, Jacksonia horrida* and *Allocasuarina lehmanniana* subsp. *lehmanniana* over sparse sedgeland of *Anarthria prolifera, Schoenus caespititius, Desmocladus flexuosus* and *Lepidosperma squamatum* on fine grey sand of upper dunal slopes.

Vegetation Condition: Excellent.

Fire Age: >5

Q9 Species	Height (m)	Form	% Cover	Dominant /Notes
Adenathos cuneatus	0.8	Shrub 0.5-1m	5	yes
Desmocladus flexuosus	0.6	Sedge	5	yes
Leucopogon obovatus subsp. *revolutus*	1.2	Shrub 1-2m	5	yes
Schoenus caespititius	0.8	Sedge	5	yes
Agonis flexuosa	5	Tree Mallee	45	yes
Jacksonia horrida	0.5	Shrub 0.5-1m	2	yes
Lepidosperma squamatum	0.8	Sedge	2	yes
Melaleuca thymoides	0.6	Shrub 0.5-1m	2	yes
Anarthria prolifera	1	Sedge	10	yes
Bossiaea linophylla	2	Shrub 1-2m	10	yes
Cyathochaeta sp.	1.2	Grass	10	yes

Q9 Species	Height (m)	Form	% Cover	Dominant /Notes
Adenanthos sericeus subsp. *sericeus*	2.5	Shrub>2m	1	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	0.8	Shrub 0.5-1m	1	yes
Banksia sessilis	1.5	Shrub 1-2m	1	yes
Eucalyptus angulosa	3	Tree Mallee	1	yes
Hakea linearis	0.8	Shrub 0.5-1m	1	
Hibbertia racemosa	0.25	Shrub <0.5m	1	
Opercularia hispidula	0.3	Forb	1	
Spyridium globulosum	2	Shrub 1-2m	1	
Patersonia occidentalis var. *occidentalis*	0.8	Sedge	0.5	
Amperea ericoides	0.3	Shrub <0.5m	0.25	
Orianthera serpyllifolia subsp. serpyllifolia	0	Forb	0.25	
Amperea ericoides	0.4	Herb	Opp	
Corybus sp.	0.1	Forb	Opp	
Hakea ruscifolia	3	Shrub 0.5-3m	Opp	
Lysinema pentapetalum	0.2	Forb	Opp	

T22024 Site: Q10 Vegetation Unit: Limestone Mallee
Described by: Vanessa Yeomans **Date:** 13/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Southern slopes of dune
Latitude: -35.0664738 **Longitude:** 117.8093596
Habitat: Dune, upper slope, 0% Bare Ground 35% Leaf Litter
Soil: Grey, Pale Brown fine sand
Rock Type: Nil

Vegetation: Closed mallee forest of *Eucalyptus angulosa* and *Agonis flexuosa* over open mid shrubland of *Hibbertia furfuracea* and *Bossiaea linophylla* over sparse sedgeland of *Lepidosperma gladiatum, Lepidosperma squamatum* and *Desmocladus flexuosus* on grey fine sand of steep southern dunal slope.

Vegetation Condition: Excellent.

Fire Age: >5

Q10 Species	Height (m)	Form	% Cover	Dominant /Notes
Eucalyptus angulosa	8	Tree	60	yes
Agonis flexuosa	5	Tree	25	yes
Bossiaea linophylla	1.5	Shrub 1-2m	1	yes
Hibbertia furfuracea	1.5	Shrub 1-2m	45	yes
Lepidosperma gladiatum	1.2	Sedge	8	yes
Lepidosperma squamatum	0.6	Sedge	5	yes
Desmocladus flexuosus	0.3	Sedge	5	yes
Clematis pubescens	2	Creeper	1	yes
Hardenbergia comptoniana	3	Creeper	1	yes
Leucopogon obovatus subsp. *revolutus*	1.5	Shrub 1-2m	1	
Opercularia hispidula	0.6	Forb	1	

T22024 Site: Q11 Vegetation Unit: Limestone Mallee/Coastal Heath Mosaic
Described by: Vanessa Yeomans **Date:** 14/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Dune hollow
Latitude: -35.0634208 **Longitude:** 117.8066249
Habitat: Dune, upper steep Slope, 5% Bare Ground 25% Leaf Litter
Soil: Grey, Pale Brown fine sand
Rock Type: Nil

Vegetation: Mallee woodland of *Agonis flexuosa* with *Eucalyptus angulosa* over tall open shrubland of *Bossiaea linophylla, Spyridium globulosum* and *Adenanthos sericeus* subsp. *sericeus* over sparse mid shrubland of *Hakea oleifolia, Allocasuarina lehmanniana* subsp. *lehmanniana* and *Leucopogon obovatus* subsp. *revolutus* over isolated low shrubs of *Opercularia hispidula* over open sedgeland of *Lepidosperma gladiatum* and *Desmocladus flexuosus* in fine grey sand of swales /hollows and lower dunal slopes.

Vegetation Condition: Excellent.

Fire Age: >5

Q11 Species	Height (m)	Form	% Cover	Dominant /Notes
Agonis flexuosa	5	Tree Mallee	25	yes
Eucalyptus angulosa	5	Tree Mallee	5	yes
Bossiaea linophylla	2	Shrub>2m	10	yes
Spyridium globulosum	3	Shrub>2m	10	yes
Adenanthos sericeus subsp. *sericeus*	3	Shrub>2m	5	yes
Hakea oleifolia	2	Shrub 1-2m	5	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.5	Shrub 1-2m	5	yes
Leucopogon obovatus subsp. *revolutus*	1.5	Shrub 1-2m	2	yes
Opercularia hispidula	0.5	Shrub 0.5-1m	2	yes
Lepidosperma gladiatum	1.5	Sedge	20	yes
Desmocladus flexuosus	0.4	Sedge	20	yes
?Eragrostis sp.	0.8	Grass	2	yes
Lysiandra calycina	0.5	Shrub 0.5-1m	1	
Lepidosperma sp.	0.2	Sedge	0.1	

T22024 Site: Q12 Vegetation Unit: Coastal Heath
Described by: Vanessa Yeomans **Date:** 14/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** High ridge running East-West
Latitude: -35.0644871 **Longitude:** 117.8068132
Habitat: Dune, upper steep Slope, 5% Bare Ground 15% Leaf Litter
Soil: Grey fine sand
Rock Type: Nil

Vegetation: Mid open shrubland of *Spyridium globulosum, Allocasuarina humilis, Adenanthos sericeus* subsp. *sericeus, Leucopogon obovatus* subsp. *revolutus* and *Banksia sessilis* over low sparse shrubland of *Acrotriche cordata* and *Acacia littorea* over sedgeland of *Desmocladus flexuosus* with isolated clumps of forbs of *Opercularia hispidula, Platysace compressa, Orianthera serpyllifolia* subsp. *serpyllifolia* and *Hibbertia racemosa* on fine grey sand of dune crest.

Vegetation Condition: Excellent.

Fire Age: >5

Q12 Species	Height (m)	Form	% Cover	Dominant /Notes
Desmocladus flexuosus	0.4	Sedge	50	yes
Allocasuarina humilis	1.5	Shrub 1-2m	10	yes
Spyridium globulosum	1.5	Shrub 1-2m	10	yes
Acrotriche cordata	0.8	Shrub 0.5-1m	5	yes
Adenanthos sericeus subsp. *sericeus*	1.5	Shrub 1-2m	5	yes
Banksia sessilis	1.5	Shrub 1-2m	5	yes
Leucopogon obovatus subsp. *revolutus*	1.5	Shrub 1-2m	5	yes
Opercularia hispidula	0.3	Forb	5	yes
Acacia littorea	1	Shrub 0.5-1m	2	yes
Lepidosperma sp.	0.5	Sedge	2	yes
Leucopogon parviflorus	1.5	Shrub 1-2m	2	yes
Platysace compressa	0.5	Forb	2	yes
?Eragrostis sp.	0.5	Grass	1	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.5	Shrub 1-2m	1	yes

Q12 Species	Height (m)	Form	% Cover	Dominant /Notes
Bossiaea linophylla	1.2	Shrub 1-2m	1	
Comesperma confertum	0.5	Shrub <0.5m	1	
Conostylis aculeata subsp. *aculeata*	0.3	Forb	1	yes
Hibbertia racemosa	0.2	Forb	1	yes
Lysiandra calycina	0.5	Shrub <0.5m	1	
Olearia axillaris	1.5	Shrub 1-2m	1	
Opercularia hispidula	0.6	Forb	1	yes
Orianthera serpyllifolia subsp. *serpyllifolia*	0.3	Forb	1	yes
Scaevola nitida	1.5	Shrub 1-2m	1	
Lysinema pentapetalum	0.3	Shrub <0.5m	0.5	
Poa drummondiana	0.3	Grass	0.1	
Caladenia latifolia	0.2	Forb	Opp	
Clematis pubescens	2	Creeper	Opp	
Eucalyptus angulosa	5	Tree Mallee	Opp	
Hibbertia furfuracea	2	Shrub 1-2m	Opp	

T22024 Site: Q13 Vegetation Unit: Coastal Limestone Heath
Described by: Vanessa Yeomans **Date:** 14/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Limestone Outcropping Hillock
Latitude: -35.0654785 **Longitude:** 117.8061394
Habitat: Dune, upper steep Slope, 45% Bare Ground 10% Leaf Litter
Soil: Grey fine sand
Rock Type: Limestone

Vegetation: Mid sparse shrubland of *Adenanthos sericeus* subsp. sericeus, *Allocasuarina lehmanniana* subsp*. lehmanniana, Acacia littorea* and *Spyridium globulosum* over low open shrubland of *Acrotriche cordata,* ***Thomasia quercifolia*** **(P4)** and *Pultenaea tenuifolia* over isolated sedges of *Desmocladus flexuosus, Netrostylis* sp. Mt Madden and *Chaetospora subbulbosa* with isolated clumps of forbs of *Opercularia vaginata* and *Hibbertia grossulariifolia* on shallow grey fine sand of limestone outcrop.

Vegetation Condition: Excellent.

Fire Age: >5

Q13 Species	Height (m)	Form	% Cover	Dominant /Notes
Acrotriche cordata	0.5	Shrub <0.5m	15	yes
Adenanthos sericeus subsp. *sericeus*	1.2	Shrub 1-2m	5	yes
Allocasuarina lehmanniana subsp. *lehmanniana*	1.2	Shrub 1-2m	5	yes
Opercularia vaginata	0.25	Forb	5	yes
Pultenaea tenuifolia	0.25	Shrub <0.5m	5	yes
Thomasia quercifolia **(P4)**	0.25	Shrub <0.5m	5	yes
Acacia littorea	1.2	Shrub 1-2m	2	yes
Desmocladus flexuosus	0.2	Sedge	2	yes
Hibbertia grossulariifolia	0.2	Creeper	2	yes
Netrostylis sp. Mt Madden	0.25	Sedge	2	yes
Spyridium globulosum	1.2	Shrub 1-2m	2	yes
?Eriachne sp.	0.2	Forb	1	yes
Chaetospora subbulbosa	0.3	Sedge	1	yes
Leucopogon parviflorus	0.8	Shrub 0.5-1m	1	yes

Q13 Species	Height (m)	Form	% Cover	Dominant /Notes
Olearia axillaris	0.8	Shrub 0.5-1m	1	yes
Scaevola nitida	1	Shrub 1-2m	1	
Logania vaginalis	0.5	Shrub 0.5-1m	0.5	
Lysinema pentapetalum	0.3	Shrub <0.5m	0.5	
Pimelea ferruginea	0.25	Shrub <0.5m	0.5	
Platysace compressa	0.3	Forb	0.5	
Senecio pinnatifolius var. *latilobus*	0.3	Forb	0.5	
Rytidosperma caespitosum	0.25	Grass	0.1	
Stylidium fasciculatum	0.1	Forb	0.1	
Thysanotus patersonii	0.2	Forb	0.1	

T22024 Site: Q14 Vegetation Unit: Peppermint Low Forest/ Coastal Heath Mosaic
Described by: Vanessa Yeomans **Date:** 15/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Dune slope
Latitude: -35.0633395 **Longitude:** 117.8054077
Habitat: Dune, 35% Bare Ground 5% Leaf Litter
Soil: Grey fine sand
Rock Type: Nil

Vegetation: Isolated clumps of low mallee trees of *Agonis flexuosa* over sparse tall shrubs of *Adenanthos sericeus* subsp. *sericeus* over mid sparse shrubland of *Melaleuca pentagona* var. *pentagona* over low open shrubland of *Pimelea rosea* subsp. *rosea, Melaleuca thymoides*, *Gyrostemon sheathii, Adenanthos cuneatus* and *Scaevola nitida* over isolated forbs of *Opercularia hispidula, Senecio pinnatifolius* var. *latilobus, Lysiandra calycina* and *Hibbertia racemosa* on fine grey sand of a dunal ridge.

Vegetation Condition: Very Good to Excellent. Weeds are listed as Opps - Weed Incursion along Roadside. Recently Burnt.

Fire Age: <3

Q14 Species	Height (m)	Form	% Cover	Dominant /Notes
Agonis flexuosa	1.5	Tree	2	yes
Adenanthos sericeus subsp. sericeus	0.2	Shrub <0.5m	2	yes
Melaleuca pentagona var. pentagona	1.5	Shrub 1-2m	15	yes
Pimelea rosea subsp. rosea	0.5	Shrub 0.5-1m	5	yes
Gyrostemon sheathii	0.5	Shrub 0.5-1m	5	yes
Adenanthos cuneatus	0.8	Shrub 0.5-1m	2	yes
Scaevola nitida	0.8	Shrub 0.5-1m	5	yes
Allocasuarina humilis	0.8	Shrub 0.5-1m	2	yes
Leucopogon obovatus subsp. revolutus	0.8	Shrub 0.5-1m	5	yes
Opercularia hispidula	0.3	Forb	5	yes
Hibbertia racemosa	0.3	Forb	2	yes
Acacia littorea	0.2	Shrub <0.5m	1	yes
Lysiandra calycina	0.3	Shrub <0.5m	1	yes
Melaleuca thymoides	0.3	Shrub <0.5m	2	yes

Q14 Species	Height (m)	Form	% Cover	Dominant /Notes
Lyginia imberbis	0.6	Sedge	10	yes
Desmocladus flexuosus	0.25	Sedge	12	yes
Anarthria prolifera	0.3	Sedge	5	yes
Lomandra sp. 1	1	Sedge	25	yes
Senecio pinnatifolius var. latilobus	0.8	Forb	2	yes
Conostylis aculeata subsp. aculeata	0.2	Forb	1	yes
Opercularia vaginata	0.25	Forb	5	yes
Hakea prostrata	0.3	Creeper	1	yes
Jacksonia horrida	0.6	Shrub 0.5-1m	5	
Bossiaea linophylla	0.8	Shrub 0.5-1m	1	
Patersonia occidentalis var. occidentalis	0.8	Shrub 0.5-1m	0.5	
Spyridium globulosum	0.8	Shrub 0.5-1m	1	
Hakea ?sulcata	0.5	Shrub <0.5m	0.1	
Chaetospora curvifolia	0.25	Sedge	1	
Lyginia imberbis	0.5	Sedge	1	
Orianthera serpyllifolia subsp. serpyllifolia	0.25	Forb	1	
Amperea ericoides	0.25	Forb	1	
Xanthosia huegelii	0.2	Forb	0.1	
Isotropis cuneifolia subsp. cuneifolia	0.2	Forb	0.1	
Platysace compressa	0.2	Forb	0.5	
Goodenia trinervis	0.3	Forb	0.5	
Thelymitra paludosa	0.25	Forb	0.1	
Lagenophora huegelii	0.25	Forb	0.1	
Lomandra sp. 2	0.2	Forb	0.1	
Kennedia coccinea	0.2	Creeper	1	
Drosera pallida	0.25	Creeper	0.1	
Hakea linearis	0.5	Shrub 0.5-1m	Opp	
Podotheca gnaphalioides	0.2	Forb	Opp	
**Trachyandra divaricata*	0.2	Forb	Opp	
**Heliophila pusilla*	0.1	Forb	Opp	
**Briza maxima*	0.1	Grass	Opp	

Q14 Species	Height (m)	Form	% Cover	Dominant /Notes
Pseudognaphalium luteolbum	0.1	Forb	Opp	
**Silene gallica* var. *gallica*	0.1	Forb	Opp	
**Bromus diandrus*	0.3	Grass	Opp	
**Dittrichia viscosa*	0.2	Forb	Opp	
?*Gladiolus sp*	0.2	Forb	Opp	
**Briza maxima*	0.1	Grass	Opp	
**Avena barbata*	0.3	Grass	Opp	
**Lagurus ovatus*	0.2	Grass	Opp	
**Pelargonium capitatum*	0.4	Shrub 0.5-1m	Opp	
**Lysimachia arvensis*	0.2	Forb	Opp	
**Orobanche minor*	0.2	Forb	Opp	
**Romulea rosea*	0.1	Forb	Opp	
Thelymitra paludosa	0.2	Forb	Opp	
Microtis media	0.2	Forb	Opp	

T22024 Site: Q15 Vegetation Unit: Coastal Limestone Heath
Described by: Vanessa Yeomans **Date:** 12/10/2022 **Type:** Quadrat 10 x 10
Season: Good -Mid-Late Spring **Location:** Exposed dune Ridge
Latitude: -35.0673932 **Longitude:** 117.8008716
Habitat: Dune, upper steep Slope, 5% Bare Ground 10% Leaf Litter
Soil: White fine calcareous sand
Rock Type: Nil

Vegetation: Tall isolated shrubland of *Adenanthos sericeus* subsp. *sericeus,* over mid open shrubland of *Spyridium globulosum, Scaevola nitida* and *Leucopogon parviflorus* over low open shrubland of *Acrotriche cordata, Thomasia quercifolia, Acacia littorea, Logania fasciculata* and *Pultenaea tenuifolia* over sparse sedgeland of *Netrostylis* sp. Mt Madden and *Desmocladus flexuosus* with sparse forbland of *Opercularia vaginata* and sparse tussock grassland of *Poa poiformis* on fine grey sand of coastal dune slope.

Vegetation Condition: Excellent. Minor Weeds on Firebreak Track

Fire Age: >5

Q15 Species	Height (m)	Form	% Cover	Dominant /Notes
Adenanthos sericeus subsp. *sericeus*	1.2	Shrub 1-2m	5	yes
Scaevola nitida	0.8	Shrub 0.5-1m	2	yes
Spyridium globulosum	0.8	Shrub 0.5-1m	15	yes
Olearia axillaris	0.8	Shrub 0.5-1m	1	yes
Leucopogon parviflorus	0.8	Shrub 0.5-1m	1	yes
Bossiaea linophylla	0.8	Shrub 0.5-1m	1	yes
Acrotriche cordata	0.3	Shrub <0.5m	10	yes
Thomasia quercifolia	0.25	Shrub <0.5m	5	yes
Pimelea ferruginea	0.25	Shrub <0.5m	2	yes
Logania fasciculata	0.3	Shrub <0.5m	5	yes
Acacia littorea	0.3	Shrub <0.5m	8	yes
Pultenaea tenuifolia	0.25	Shrub <0.5m	5	yes
Netrostylis sp. Mt Madden	0.25	Sedge	5	yes
Desmocladus flexuosus	0.25	Sedge	5	yes
Poa poiformis	0.3	Grass	10	yes

Q15 Species	Height (m)	Form	% Cover	Dominant /Notes
Opercularia vaginata	0.25	Forb	15	yes
Senecio pinnatifolius var. *latilobus*	0.3	Forb	0.2	yes
Cassytha racemosa forma pilosa	0.2	Creeper	5	yes
Hibbertia grossulariifolia	0.2	Creeper	1	yes
Clematis pubescens	0.3	Creeper	0.5	yes
Leucopogon obovatus subsp. *revolutus*	0.8	Shrub 0.5-1m	0.5	
Banksia sessilis	0.3	Shrub <0.5m	1	
Lysiandra calycina	0.3	Shrub <0.5m	1	
Lepidosperma gladiatum	1.2	Sedge	1	
Lepidosperma pubisquameum	0.3	Sedge	0.1	
Conostylis aculeata subsp. *aculeata*	0.2	Forb	0.2	
Isotropis cuneifolia subsp. *cuneifolia*	0.2	Forb	0.1	
Stylidium fasciculatum	0.25	Forb	0.25	
Trachymene pilosa	0.1	Forb	0.1	
Podotheca angustifolia	0.1	Forb	0.1	
Cassytha racemosa forma *pilosa*	0.5	Creeper	0.1	
Caladenia latifolia	0.15	Herb	Opp	
Diuris jonesii	0.15	Herb	Opp	

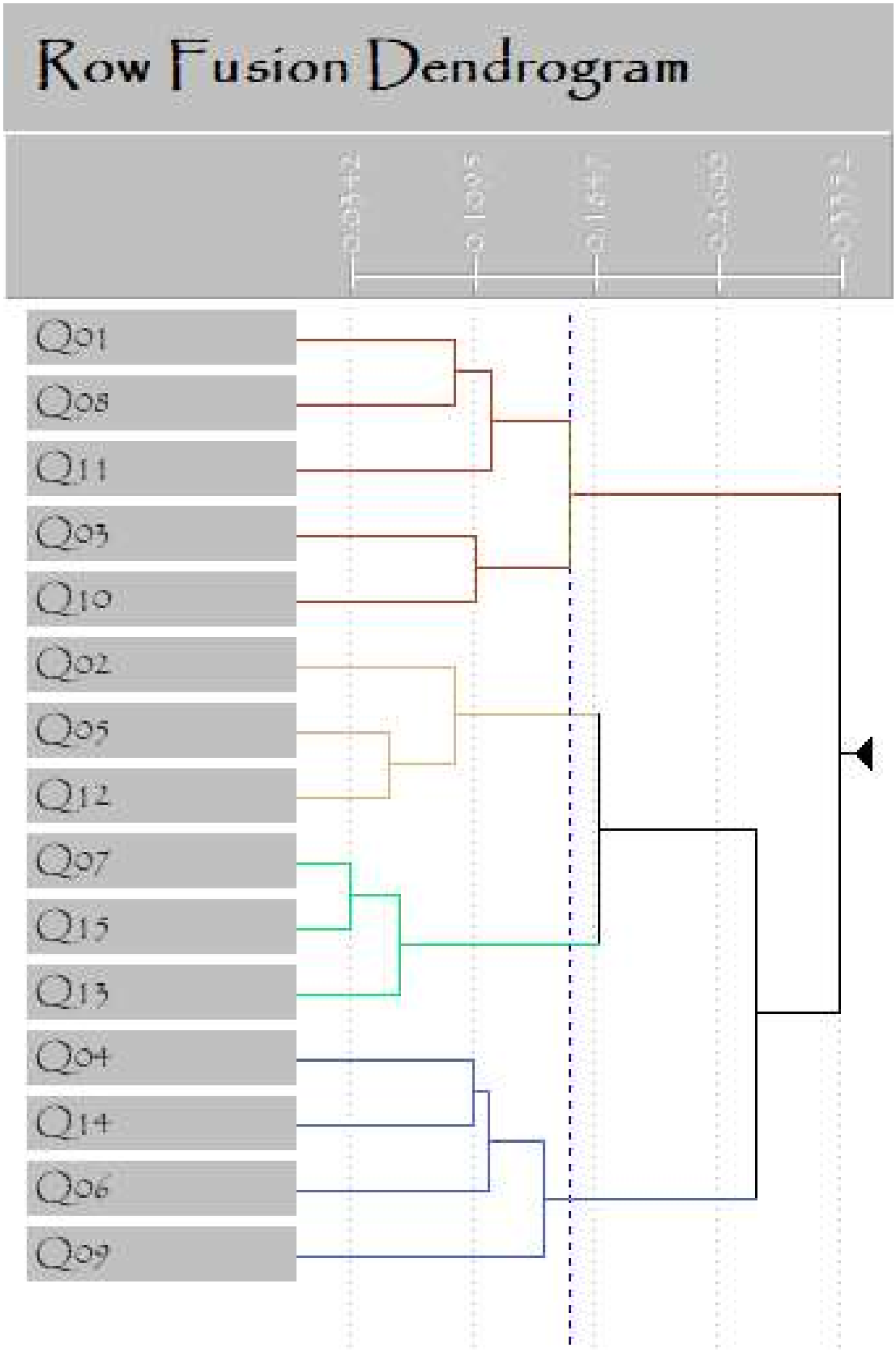
Appendix F: Species by Site Matrix

Quadrat	*?Austrostipa* sp.	*?Eragrostis* sp.	*?Eriachne* sp.	*Acacia cochlearis*	*Acacia littorea*	*Acrotriche cordata*	*Adenanthos cuneatus*	*Adenanthos sericeus* subsp. *sericeus*	*Agonis flexuosa*	*Allocasuarina humilis*	*Allocasuarina lehmanniana* subsp. *lehmanniana*	*Ammothryon grandiflorum*	*Amperea ericoides*	*Anarthria prolifera*	*Anarthria* sp.	*Anthocercis littorea*	*Austrostipa* sp. *1*	*Austrostipa* sp. *2*	*Austrostipa* sp. *3*	*Banksia dallanneyi* subsp *dallanneyi* var. *dallanneyi*	*Banksia sessilis*	*Billardiera fusiformis*	*Billardiera heterophylla*	*Bossiaea linophylla*	*Cassytha racemosa* forma *pilosa*	*Chaetospora curvifolia*	*Chaetospora subbulbosa*	*Chorizema ilicifolium*	*Clematis pubescens*	*Comesperma confertum*	*Conostylis aculeata subsp. aculeata*	*Cyathochaeta* sp.	*Desmocladus flexuosus*	*Drosera ?erythrogyne*	*Drosera pallida*	*Eucalyptus angulosa*
Q1					1			15	60		0.1			0.1									0.1	2	0.1				0.1				0.1			0
Q2					5			25			10	0.1				0.1				0.1				2					0.2		0.1		25			0
Q3					2				10					1										10					2				2			65
Q4					2		2			25				35						1	1	0.3		25												0
Q5				10	35	15		5			1					10					0.3			2							1		15			0
Q6					25				35	5					0.1						5			15				0.1								
Q7	0.1				5	5.1		8			10						0.1				1			1				0.1	0.5	0.1	1		30			0
Q8					1		1	10						1				0.1	0.1					10					2				45	0.1		75
Q9							5	1	45		1		0.3	10							1			10								10	5			1
Q10									25															1					1				5			60
Q11		2						5	25		5													10									20			5
Q12		1			2	5		5		10	1										5			1						1	1		50			0
Q13			1		2	15		5			5																1						2			0
Q14					1		2	2	2	2			1	5										1		1					1		12		0.1	0
Q15					8	10		5													1			1	5.1				0.5		0.2		5			0

Quadrat	*Exocarpos sparteus*	*Gahnia* sp. Headland	*Goodenia trinervis*	*Gyrostemon sheathii*	*Hakea ?sulcata*	*Hakea linearis*	*Hakea oleifolia*	*Hakea prostrata*	*Hakea ruscifolia*	*Hardenbergia comptoniana*	*Hibbertia cuneiformis*	*Hibbertia furfuracea*	*Hibbertia grossulariifolia*	*Hibbertia racemosa*	*Isotropis cuneifolia* subsp. *cuneifolia*	*Jacksonia horrida*	*Kennedia coccinea*	*Lagenophora huegelii*	*Lepidosperma gladiatum*	*Lepidosperma pubisquameum*	*Lepidosperma* sp	*Lepidosperma squamatum*	*Leucopogon obovatus* subsp. *obovatus*	*Leucopogon obovatus* subsp. *revolutus*	*Leucopogon parviflorus*	*Leucopogon reflexus*	*Logania fasciculata*	*Logania vaginalis*	*Lomandra* sp.	*Lomandra* sp. 1	*Lomandra* sp. 2	*Lyginia imberbis*	*Lysiandra calycina*	*Lysinema pentapetalum*	*Melaleuca pentagona var. pentagona*	*Melaleuca thymoides*	*Netrostylis* sp. Mt Madden	*Pimelea rosea* subsp. *rosea*	*Platysace compressa*
Q1																			45			1		1														
Q2														0.1								5.1				10			0.1				0.1			0.1		0.6	0.1
Q3										1		35										15		20															
Q4			2	1		0.3			1			5		2		10		1				2	1	10		1								2		1		0.3	1
Q5	1	0.5		1		1								2								20											0.3						5
Q6				5																		0.1	0.1		0.1	1											10	
Q7		0.1									0.1		2		0.1			0.1	1					1	5.1			1					0.5				0.1		1
Q8		5										5												10	1								0.3						1
Q9						1								1		2						2		5												2			
Q10										1		45							8			5		1															
Q11							5												20		0.1			2								1							
Q12														1							2			5	2							1	0.5					2
Q13													2												1			0.5					0.5			2		0.5
Q14			0.5	5	0.1			1						2	0.1	5	1	0.1						5						25	0.1	11	1		15	2		5	0.5
Q15													1		0.1				1	0.1				0.5	1		5						1				5		

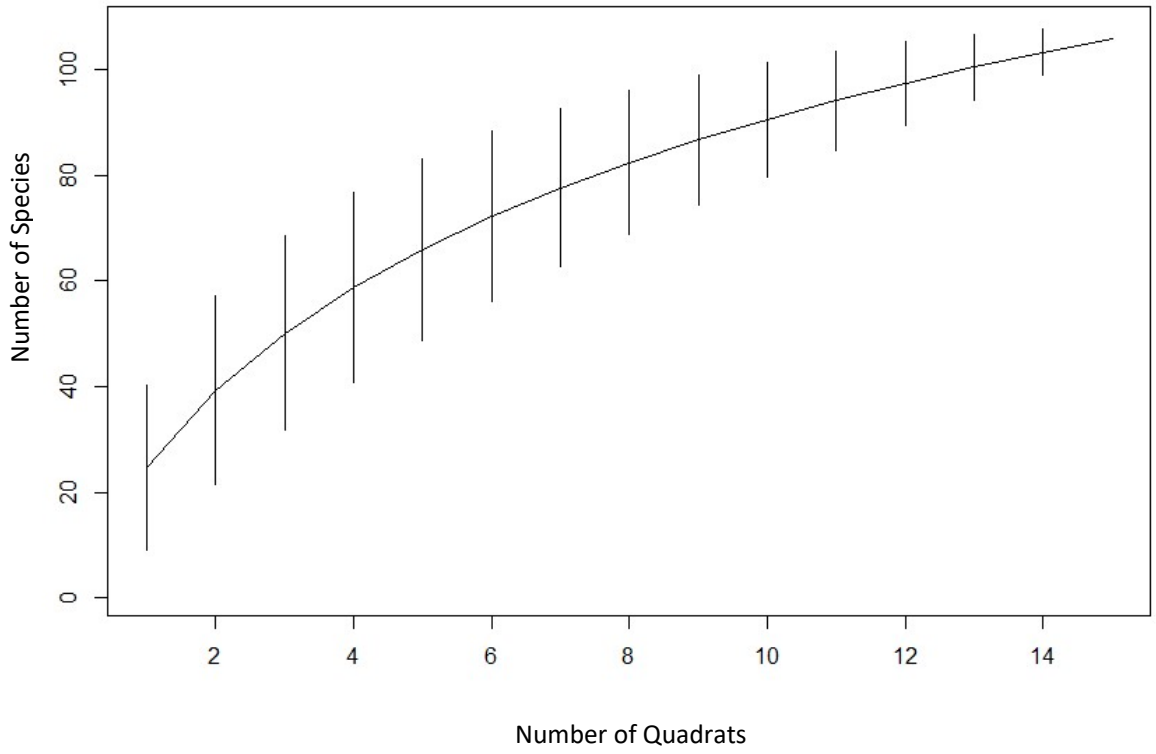
	Poa ?porphyroclados	*Poa drummondiana*	*Poa poiformis*	*Podotheca angustifolia*	*Pultenaea tenuifolia*	*Rhagodia baccata* subsp. *baccata*	*Rhodanthe citrina*	*Rytidosperma caespitosum*	*Scaevola nitida*	*Schoenus caespititius*	*Senecio pinnatifolius* var. *latilobus*	*Spyridium globulosum*	*Spyridium majoraniifolium*	*Stylidium fasciculatum*	*Thelymitra paludosa*	*Thomasia quercifolia*	*Thysanotus patersonii*	*Trachymene pilosa*	*Trymalium ledifolium* var. *rosmarinifolium*	*Xanthosia huegelii*
Quadrat						1						5.1								
Q1	0.1		0.1				0.1			0.1		5			0.1					
Q2												5								
Q3										10		1								0.5
Q4									1		0.3	1	15						2	
Q5									45			0.1	0.1							
Q6			0.1						2			25		0.5		35	0.2		1	
Q7											0.2	1							0.3	
Q8										5		1								
Q9																				
Q10												10								
Q11		0.1							1			10								
Q12					5			0.1	1		0.5	2		0.1		5	0.1			
Q13									5		2	1			0.6					0.1
Q14			10	0.1	5				2		0.2	15		0.3		5		0.1		
Q15																				

Appendix G: PATN Floristic Analysis and Species Accumulation Curve


Row Fusion Dendrogram
Q01
Q08
Q11
Q03
Q10
Q02
Q05
Q12
Q07
Q15
Q13
Q04
Q14
Q06
Q09

Two-way Table

Species Accumulation Curve^ Sand PatchDetailed Flora and Vegetation Survey 2022



^Species accumulation Curve conducted using Rstudio Version: 2022.12.0+353 Vegan Package, using the 'exact' method or the Mao Tau estimate to determine expected species richness.