360 environmental

Water Corporation Site, Denham

Flora and Fauna Report

Prepared for:

Horizon Power

November 2019

people planet professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
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Executive Summary

Horizon Power commissioned 360 Environmental Pty Ltd to undertake a biological survey and assessment to support the proposed construction of a new hybrid (solar, diesel, battery storage) power station in Denham, Western Australia. A flora and fauna survey were completed within the defined area, approximately 2 km north east of the Denham townsite, in the Carnarvon bioregion.

Flora and Vegetation

The desktop assessment identified 37 conservation significant species occurring within 50 km of the Survey Area. A likelihood of occurrence assessment was undertaken and determined nine species as having a high likelihood of occurrence, 12 species as having a medium likelihood of occurrence, 13 species as having a low likelihood of occurrence and a total of three species were recorded within the Survey Area.

The detailed flora and vegetation survey recorded the floristic composition and vegetation types from four quadrats, one releve and additional mapping notes. The survey recorded a total of 59 taxa from 45 genera across 29 families.

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded during the survey.

Three DBCA listed Priority flora were recorded or potentially record within the Survey Area in *Acanthocarpus affinis rupestris* (P2), *Olearia ?occidentissima* (P2) and *Triodia plurinervata* (P3). The presence of these species is unlikely to be a statutory constraint for the Survey Area and is dealt with by DWER and DBCA on a case by case basis.

A total of three vegetation types were mapped across the Survey Area:

- AlTdTp: *Triodia* Hummock Grassland (12.51 ha)
- AlCrAp: *Acacia* Shrubland (0.35 ha)
- AlTdAp: Myrtaceae Low Shrubland (0.74 ha).

Towards the southern portion of the Survey Area and along the linear route, a significant change in vegetation is observed due to the loss of *Triodia plurinervata* dominant grasslands. This change is expected and consistent with broad scale soil and vegetation mapping.

Vegetation condition within the Survey Area ranged from Excellent to Completely Degraded consisting of:

- Excellent: 9.13 ha, 67.4%
- Very Good: 3.52 ha, 26.0%
- Good: 0.14 ha, 1.0%
- Degraded: 0.03 ha, 0.2 %
- Completely Degraded (cleared areas): 0.7 ha, 5.4%

Five introduced species were recorded during the survey. One species, **Lycium ferocissimum* is listed as a Weed of National Significance by the Department of Energy and Environment (2018).

Vertebrate Fauna

A total of 213 vertebrate fauna species were retrieved from the DBCA database searches. Of these, 37 are conservation significant vertebrate fauna species from 15 families, and includes:

- 134 bird species, including 31 species of conservation significance
- 14 mammal species, including three species of conservation significance
- 65 reptile species, including three species of conservation significance
- No amphibian species, and therefore no species of conservation significance.

The field survey recorded 40 terrestrial vertebrate fauna species, comprised of 26 birds and 10 mammals and six reptiles. No fauna species of conservation significance (Threatened or Priority), or evidence such as tracks or scats, were recorded within the Survey Area.

A total of seven fauna habitat assessments were undertaken during the field survey, with three fauna habitat types being identified as:

- *Acacia* Shrubland
- *Acacia* Shrubland, over *Triodia*
- Cleared/Completely Degraded.

The results of the likelihood of occurrence assessment determined that:

- No fauna species of conservation significance were recorded within the Survey Area
- Two fauna species of conservation significance are considered to have a high likelihood of occurrence within the Survey Area:
    - Osprey (*Pandion haliaetus*) – Migratory/Marine
    - Western Grasswren (*Amytornis textilis textilis*) – Priority 4
- Eight conservation significant fauna species are considered to have a medium likelihood of occurrence within the Survey Area. This includes four marine/coastal birds, as well as the following three terrestrial species:
    - Pacific Swift (*Apus pacificus*) – Migratory/Marine
    - Malleefowl (*Leipoa ocellata*) – Vulnerable
    - Bilby (*Macrotis lagotis*) – Vulnerable
    - Woma (*Aspidites ramsayi*) – Priority 1 (South West Population)

- The remaining 27 conservation significant species are considered to have a low likelihood of occurrence.

None of the fauna habitats identified within the Survey Area are considered to be preferred habitat for any of the conservation significant species considered to have a high or medium likelihood of occurrence. It is therefore considered that any potential disturbance within the Survey Area is unlikely to impact these species.

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1 Introduction

1.1 The Project

Horizon Power commissioned 360 Environmental Pty Ltd (360 Environmental) to undertake a biological survey and assessment to support the proposed construction of a new hybrid (solar, diesel, battery storage) power station in Denham, Western Australia (herein known as the Project). A flora and fauna survey was completed within the defined area, approximately 2 km north east of the Denham townsite, in the Carnarvon bioregion (herein referred to as the Survey Area).

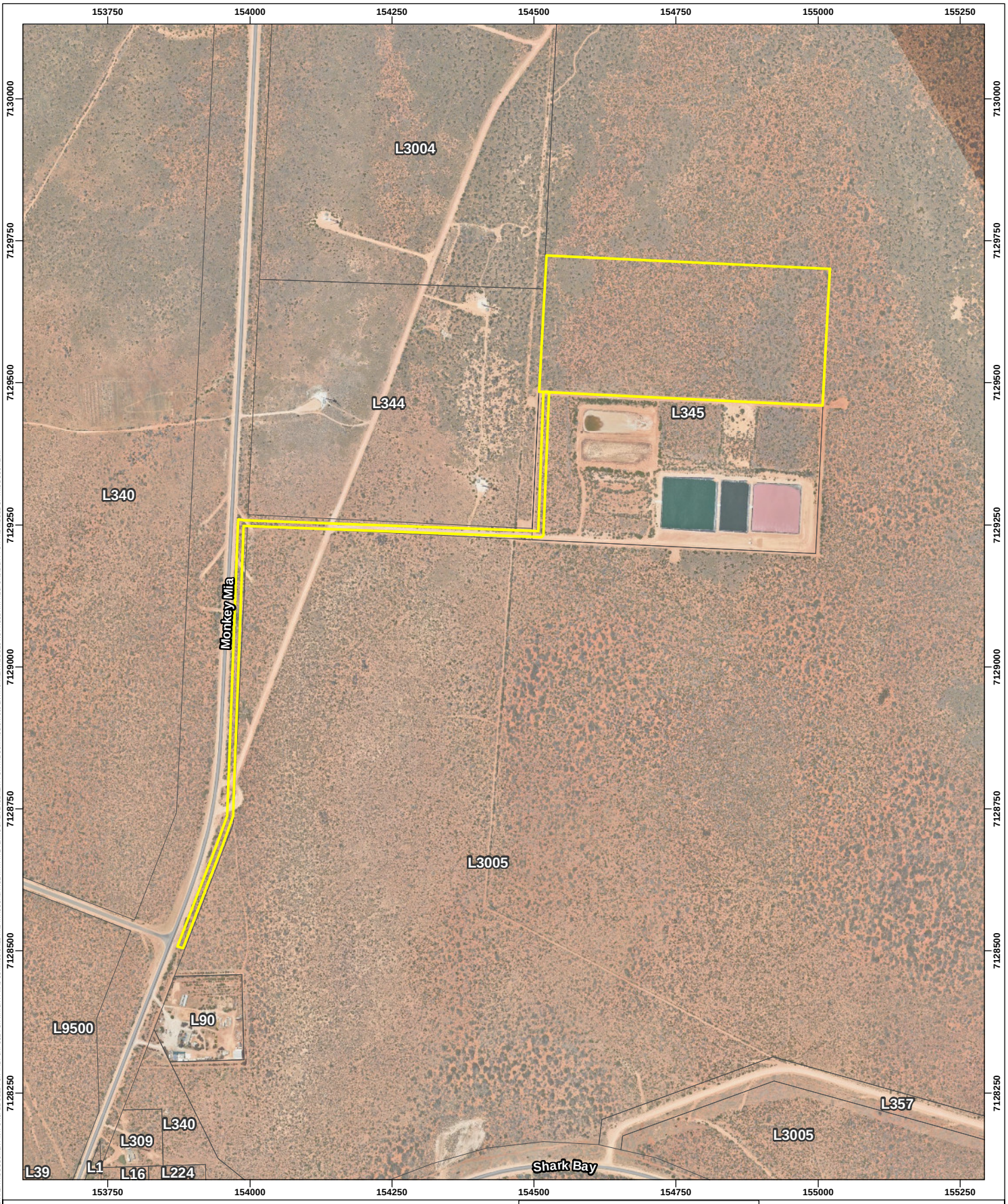
The Survey Area comprised a portion of Lot 345 and an associated track, covering approximately 13.5 hectares (ha) (Figure 1).

1.2 Objectives and Scope

The purpose of the survey is to delineate key flora and fauna values within the Survey Area and identify potential environmental sensitivities that may impact the Project.

The scope of works includes:

- Desktop Assessment
- Field Survey
- Post Survey Debrief Email
- Biological Report
- GIS Spatial Data.



Legend

- Survey
- Lot Boundaries
- State Road

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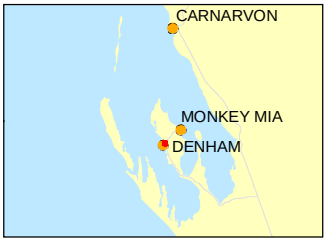
LOCALITY MAP



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Water Corporation Site

Detailed Flora and Fauna Survey

Figure 1 Survey Area

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2 Background

2.1 Protection of Flora, Vegetation and Fauna

Western Australian flora and fauna is protected formally and informally by legislative and non-legislative measures, which are as follows:

Legislative measures:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Threatened Species Scientific Committee, 2015)
- WA *Biodiversity Conservation Act 2016* (BC Act)
- WA *Environmental Protection Act 1986* (EP Act)
- WA *Biosecurity and Agriculture Management Act 2007* (BAM Act).

Non-legislative measures:

- WA Department of Biodiversity Conservation and Attractions (DBCA) Priority lists for fauna, flora and ecological communities
- Weeds of National Significance (WoNS) and
- Recognition of locally significant populations by DBCA.

2.2 Biophysical Environment

2.2.1 Climate

The closest long-term Bureau of Meteorology (BoM) weather station with a complete dataset is Denham (Station 6044), located approximately 2 km southwest of the Survey Area.

The long-term mean minimum temperature for Denham ranges from 12.7°C (July) to 22.9°C (February) (1988 to 2019) and the long-term mean maximum temperature ranges from 21.8°C (July) to 31.8°C (February) (1988 to 2019) (Figure 2) (Bureau of Meteorology, 2019). The long-term annual average rainfall is 223.2 millimetres (mm) (1893 to 2019) (Bureau of Meteorology, 2019).

The Denham weather station recorded 146.0 mm of rainfall in the 12 months prior to the survey (July 2018 to June 2019), which is 77.3 mm below to the long-term average of 223.2 mm (Bureau of Meteorology, 2019). In the three months prior to the survey (April 2019 to June 2019), 81.2 mm of rainfall was recorded, which is 23.2 mm below the long-term average of 104.4 mm for the same time period (1893 to 2019) (Bureau of Meteorology, 2019). Six weeks prior to the survey being undertaken the Denham weather station recorded a total of 60.4 mm of rain in three successive days inclusive of the 7th, 8th and 9th of June 2019 (Bureau of Meteorology, 2019).

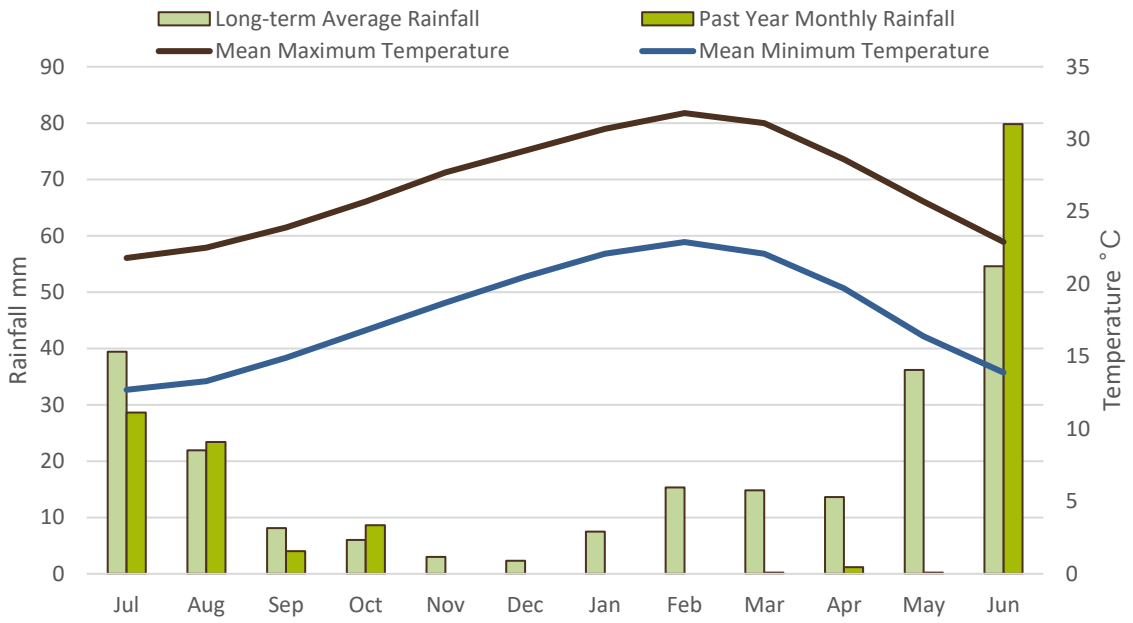


Figure 2: Long term and Monthly Total Rainfall, Maximum and Minimum temperatures for Denham (6044) (Bureau of Meteorology, 2019)

2.2.2 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of the Environment and Energy, 2016).The Survey Area occurs within the Carnarvon bioregion and the Wooramel (CAR2) subregion.

The Wooramel Subregion is characterised by alluvial plains associated with downstream sections and deltas of Gascoyne, Minilya and Wooramel Rivers. The subregion is represented by tree to shrub steppe over hummock grasslands on and between aeolian red sand dunefields, extensive in the north and east as well as on top of Kennedy Range (Desmond and Chant, 2001). The demonstrated of permian sediments are common in northern parts (Desmond and Chant, 2001). Southern areas comprise limestone plateaux overlain by red sand plains. Saline alluvial plains with samphire and saltbush low shrublands in near-coastal areas (Desmond and Chant, 2001).

2.2.3 Soil Landscapes and Land Systems

Soil landscapes and land system mapping of Western Australia describes broad soil and landscape characteristics from regional to local scales, and has been captured at scales ranging from 1:20,000 to 1:250,000 (Department of Agriculture and Food WA, 2012). The Survey Area occurs completely within the Peron System (Figure 3), however, it is located on the southern border of the Taillefer System. Due to the Survey Areas proximity to the border, both land systems and are described below:

- **Taillefer System** described as undulating sandy plains of calcareous sand over limestone with minor limestone ridges, with low coastal dunes and sea cliffs supporting mainly hard spinifex grasslands with numerous shrubs
- **Peron System** described as undulating plains of calcareous sand supporting low *acacia* shrublands and *Lamarchea hakeifolia* heaths (Department of Agriculture and Food WA, 2012).

2.2.4 Hydrology and Wetlands

The Survey Area does not intersect any major watercourses or water bodies (Department of Water and Environmental Regulation, 2016). The closest watercourses to the Survey Area are described below:

- Little Lagoon, a natural pool located approximately 1.2 km to the north west of the Survey Area
- Wastewater Treatment Plant, an open water body occurring directly adjacent the Survey Area to the south.

2.3 Biological Environment

2.3.1 Broad Vegetation Types

Mapping of pre-European broad vegetation within Western Australia was completed on a broad scale (1:1,000,000) by (Beard, 1976). These vegetation types were later re-assessed by Shepherd et al. (2002) with some larger vegetation units divided into smaller units. Together, this pre-European database contains a total of 819 vegetation types within Western Australia.

Two broad vegetation types are mapped over the Survey Area (Figure 4). These vegetation types areas described below and their representation at a local, regional and state level is shown in Table 1.

- **Perron 112**: Shrub-steppe, Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp.
- **Denham 1101**: Thicket, Wattle, *Casuarina* and teatree *acacia-allocasuarina-melaleuca* alliance.

Table 1: Broad Vegetation Types within the State, Regional and Local Representation (Department of Biodiversity Conservation and Attractions, 2019a)

Vegetation Type	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Current Extent Managed in DBCA Lands (%)
Representation across Western Australia				
Perron 112	26,454.24	25,150.08	95.07	4.39
Denham 1101	19,737.03	16,260.14	82.38	58.79
Representation across the Carnarvon Bioregion				
Perron 112	20,101.96	20,010.92	99.55	1.75
Denham 1101	15,232.09	15,232.09	100	70.29
Representation across the Wooramel subregion				
Perron 112	20,101.96	20,010.92	99.55	1.75
Denham 1101	15,232.09	15,232.09	100	70.29
Representation across the Shire of Shark Bay				
Perron 112	26, 454.24	25,150.08	95.07	4.39
Denham 1101	16,263.62	16,260.14	99.8	71.35

2.3.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared to prevent degradation of important environmental values such as Threatened flora, TECs or significant wetlands. Exemptions contained in the *Environmental Protection (Clearing of Native vegetation) Regulations 2004* for low impact land clearing do not apply in ESAs and a clearing permit is required.

The entire Survey Area is identified within a mapped ESA. This ESA comprises the entire western portion of the Shire of Shark Bay and is likely attributed to the World Heritage Property of the Shark Bay (Department of Water and Environmental Regulation, 2018). The Survey Area and the surrounding townsite of Denham area mapped as excluded from the boundary of the of the World Heritage Area (Department of Sustainability Environment Water Population and Communities, 2012). However, the ESA mapping is likely to reflect associated buffers.

The Shark Bay World Heritage area covers 23,000 km^2 and is defined by the following key features (Department of Water and Environmental Regulation, 2018):

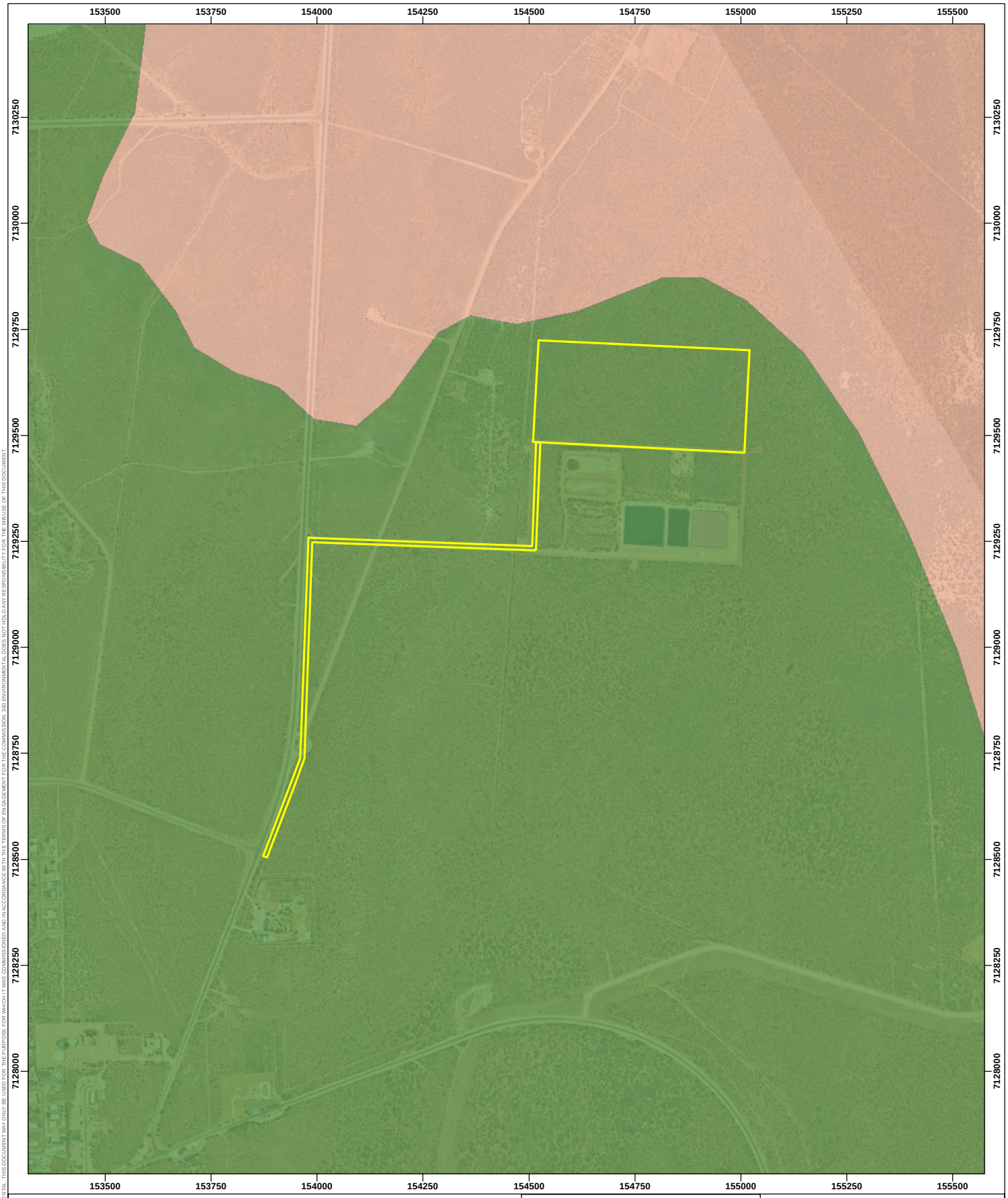
- Covers three major climatic regions and forms a change-over between two major groups of plant species – the South West and Eremaean provinces
- Twenty-five per cent (283 species) of the area's vascular plants are at the limits of their range in Shark Bay. Many vegetation associations and plant species are found only in the areas between different biological zones
- The area south of Freycinet Estuary contains the unique type of vegetation known as tree heath. There are also at least 51 species endemic to the region and others that are considered new to science

- The area is of major zoological importance, primarily due to habitats on peninsulas and islands being isolated from the disturbance that has occurred elsewhere. Of the 26 species of endangered Australian mammals, five are found on Bernier and Dorre Islands. These are the Boodie or Burrowing Bettong, Rufous Hare Wallaby, Banded Hare Wallaby, the Shark Bay Mouse and the Western Barred Bandicoot
- Also rich in avifauna with over 230 species or 35 per cent of Australia's bird species have been recorded. A number of birds attain their northern limit at Shark Bay including the Regent Parrot, Western Yellow Robin, Blue-Breasted Fairy Wren and Striated Pardalote
- The region is noted for the diversity of its amphibians and reptiles, supporting nearly 100 species. Again, many species are at the northern or southern limit of their range. The area is also significant for the variety of burrowing species, such as the Sandhill frog, which apparently needs no surface water. Shark Bay is home to three endemic sand swimming skinks, and 10 of the 30 dragon lizard species found in Australia
- The 12 species of seagrass found in Shark Bay make it one of the most diverse seagrass assemblages in the world. Seagrass covers over 4,000 square km of the bay, and the 1,030 km^2 Wooramel Seagrass Bank is the largest structure of its type in the world
- Seagrass has contributed significantly to the evolution of Shark Bay. It has modified the physical, chemical and biological environment as well as the geology and has led to the development of major marine features such as Faure Sill. Faure Island is an emergent portion of the 'Faure Sill', a sandbar overlaying sandstone that crosses the eastern gulf of Shark Bay from Peron Peninsula to the mainland. Interestingly, it is this sandbar that has created the vast areas of sandy hypersaline shallows that support the famous Stromatolites of Shark Bay
- The barrier banks associated with the growth of seagrass over the last 5,000 years – and the low rainfall, high evaporation and low tidal flushing – have produced the hypersaline Hamelin Pool and L'haridon Bight. This hypersaline condition is conducive to the growth of cyanobacteria which trap and bind sediment to produce a variety of mats and structures including Stromatolites
- Stromatolites represent the oldest form of life on earth. They are representative of life-forms which lived some 3,500 million years ago. Hamelin Pool contains the most diverse and abundant examples of Stromatolite forms in the world
- Shark Bay is renowned for its marine fauna. The population of about 10,000 dugong, dolphins, humpback whales, green and loggerhead turtles are found in Shark Bay near their southern limits, with loggerhead turtles nesting on the beaches of Dirk Hartog Island and Peron Peninsula.

2.3.3 Conservation Areas

The Survey Area is not identified within a Conservation Area. The closest areas of conservation to the Survey Area are described below and shown in Figure 5.

- Francois Peron National Park located 2.2 km to the north of the Survey Area and is vested under the Conservation Commission of Western Australia
- Shark Bay Marine Park, inclusive of Little Lagoon, located 1.2 km to the north west of the Survey Area and is vested under the Marine Parks and Reserves Authority (Department of Biodiversity Conservation and Attractions, 2017).



Legend

Survey Area

Soil and Land Systems

237Pn: Undulating plains of calcareous sand supporting low acacia shrublands and Lamarchea hakeifolia heaths.

237Ti: Undulating sandy plains of calcareous sand over limestone with minor limestone ridges, low coastal dunes and sea cliffs supporting mainly hard spinifex grasslands with numerous shrubs.

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LOCALITY MAP

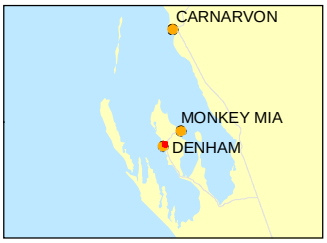

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Figure 3
Soil and Land Systems

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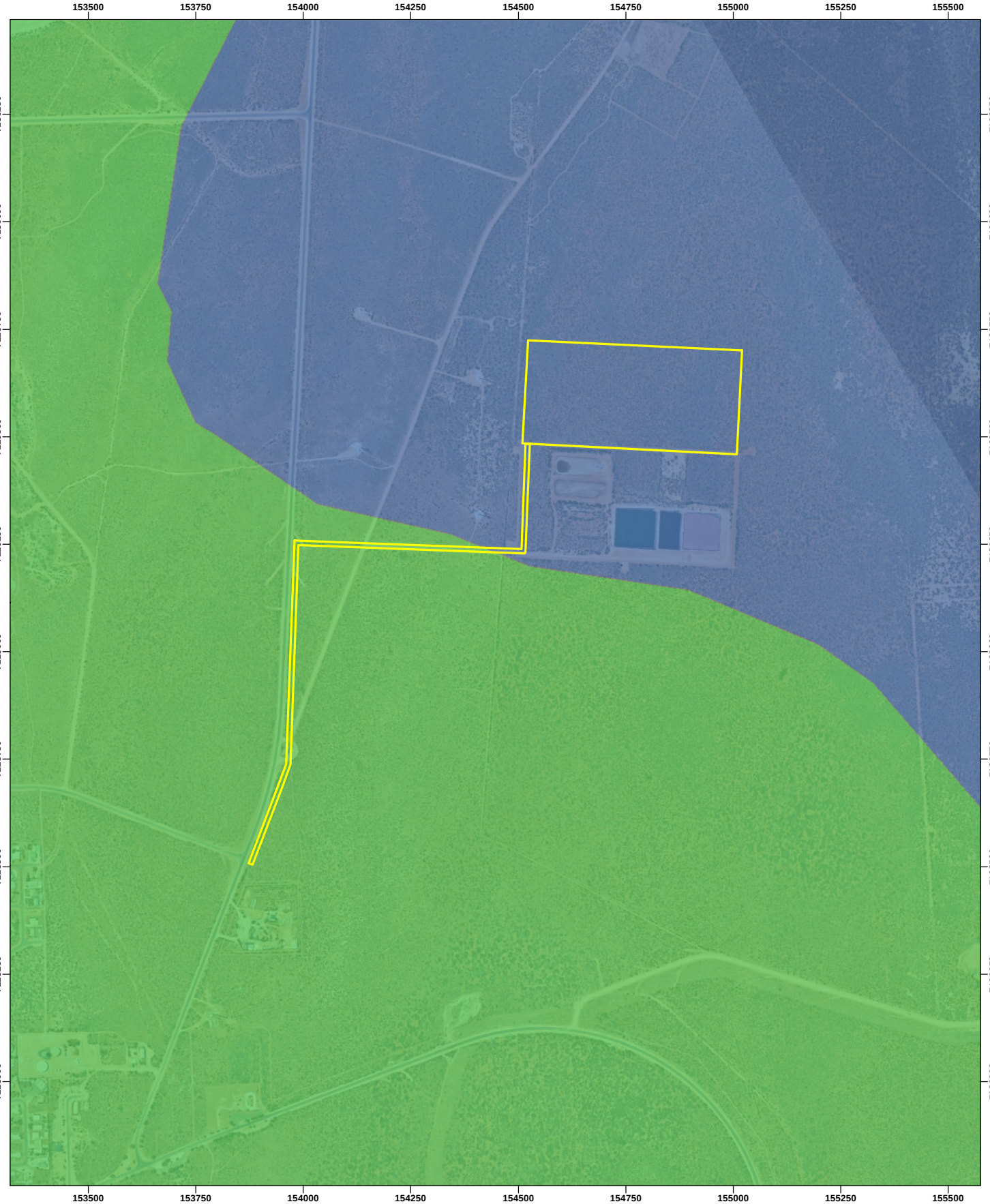

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Survey Area

Pre-European Vegetation

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- PERON_112

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LOCALITY MAP

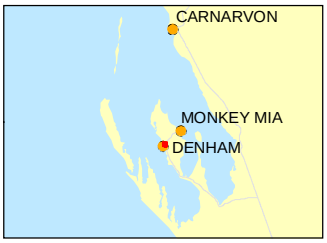

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Figure 4

Broad Vegetation Types

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Legend

- Survey Area
- Environmentally Sensitive Areas
- DBCA Managed Land
- DBCA Managed Marine

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Figure 5 Conservation and Environmentally Sensitive Areas

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3 Methods

3.1 Requirements for Flora and Fauna Surveys

This survey has been carried out as per the EPA requirements for environmental surveying and reporting of flora and fauna surveys in Western Australia where relevant, and as documented in:

Western Australia

- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority, 2016a)
- Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (Environmental Protection Authority, 2016b)
- Technical Guidance – Terrestrial Fauna Surveys (Environmental Protection Authority, 2016c).

Federal

- Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Department of the Environment, 2013)
- Survey Guidelines for Australia's threatened mammals (Department of Sustainability Environment Water Population and Communities, 2011)
- Survey guidelines for Australia's threatened birds Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (Department of the Environment Water Heritage and the Arts, 2010).

3.2 Desktop Assessment

3.2.1 Database Searches

Database searches were undertaken to identify potential conservation significant flora and fauna taxa and Ecological Communities within or surrounding the Survey Area (herein known as the Study Area). Database search particulars are outlined in Table 2. The search buffer is comprised of 20 km, with the exception being the DBCA flora database searches which was increased to 50 km as recommended by DBCA.

Priority Ecological Communities (PEC) and Threatened Ecological Communities (TEC) within the Carnarvon bioregion were examined to determine if any corresponded with the Survey Area (Appendix A). In addition, an EPBC Protected Matters Search (PMST) was undertaken to identify the potential for Matters of National Environmental Significance (MNES) to occur within or surrounding the Survey Area (Department of the Environment and Energy, 2019).

Table 2: Database Searches of the Survey Area

Database Name	Date Received	Search Target	Search Area
Threatened and Priority Ecological Communities database (Department of Biodiversity Conservation and Attractions, 2019d)	13 June 2016	Listed TECs and PECs	20 km search buffer of the Survey Area
Threatened and Priority Flora Database (TPFL) (Department of Biodiversity Conservation and Attractions, 2019g)	31 May 2019	Threatened Priority Flora	50 km search buffer of the Survey Area
DBCA Threatened and Priority Flora Species List (TP list) (Department of Biodiversity Conservation and Attractions, 2019g)	31 May 2019		50 km search buffer of the Survey Area
Western Australian Herbarium flora (Department of Biodiversity Conservation and Attractions, 2019f)	31 May 2019		50 km search buffer of the Survey Area
DBCA Threatened and Priority Fauna List (Department of Biodiversity Conservation and Attractions, 2019e)	31 May 2019	Threatened Priority Fauna	20 km search buffer of the Survey Area
NatureMap (Department of Biodiversity Conservation and Attractions, 2019c)	17 July 2019	Threatened Priority Flora and Fauna	20 km search buffer of the Survey Area
Protected Matters Search Tool (Department of the Environment and Energy, 2019)	17 July 2019		20 km search buffer of the Survey Area

3.2.2 Likelihood of Occurrence

Conservation significant flora and fauna species identified from the desktop assessment were further examined to determine a likelihood of occurrence both prior and post field survey. The assessment was completed based on the likelihood of occurrence criteria presented in Table 3. Only species either recorded within the Survey Area or considered as having a high or medium likelihood of occurrence will be discussed in detail. Species classified as having a low likelihood of occurrence based on the above criteria will not be discussed unless a justification for this classification is required.

Table 3: Likelihood of Occurrence Criteria

Likelihood	Flora	Fauna
Recorded	Flora and fauna species recorded within the Survey Area during the field survey.	
High	Previously recorded within Survey Area or within 15 km and suitable habitat potentially occurs in the Survey Area	Preferred habitat is present in the Survey Area and known species distribution has been recorded on more than one occasion within 20 km of the Survey Area in the last 15 years
Medium	Previously recorded within 15 to 50 km of the Survey Area and/or suitable habitat potentially occurs in the Survey Area	The species has been recorded on more than one occasion within 20 km of the Survey Area in the last 15 years, but limited appropriate habitat occurs in the Survey Area; or the High Likelihood of Occurrence criteria has not been met, however the species is known from the general area and has good dispersal abilities; or Preferred habitat for the species occurs in the Survey Area but the species has not been recorded within 20 km in the last 15 years
Low	No suitable habitat appears to be present in the Survey Area and records are greater than 50 km	No suitable habitat is present within the Survey Area or outside the species known distribution; or the species is known from the general area but has poor dispersal abilities

3.2.3 Literature Review

A literature review was undertaken to identify any previously completed surveys within the general region. This includes reviewing all publicly available reports to assist with understanding any key biological findings nearby.

3.3 Flora and Vegetation

3.3.1 Field Survey

A detailed single season flora and vegetation survey was undertaken by Principal Botanist Catherine Krens (Flora Licence SL012486) and Ecologist Colleen McDonald (Flora Licence SL 012436) from the 24th to the 26th of July 2019. The field survey included an assessment of four quadrats, one releve, mapping notes, vegetation condition notes, opportunistic flora collections, observations and a targeted Priority flora search. One releve was undertaken in place of quadrat in order to delineate vegetation within the boundary of the wastewater treatment plant that was unable to be traversed on foot. The Survey effort and quadrat locations are shown in Figure 6.

A minimum of three quadrats of 30 x 30 m (900 m^2) were installed in representative vegetation types. Each quadrat was accurately measured using measuring tapes, and the northwest corner was demarcated with a steel fence dropper. At the NW corner of each

quadrat, the location was recorded using a handheld Garmin GPS unit, and Fulcrum mobile data collection device with a photograph.

At each quadrat, the following data was recorded:

- Site code – a unique identifier allocated to each quadrat
- Date and recorder – a record of the date of quadrat sample and a list of the personnel involved in sampling the quadrat
- Location – GPS coordinates (MGA94) measured from the north west corner of the quadrat
- Dimensions – the size and shape of the quadrat
- Landform and soil description – a description of the quadrat habitat
- Additional site descriptors – location information that might be useful in vegetation classification including, slope, aspect, litter cover, bare ground cover and fire history
- Species list – a comprehensive vascular flora species list
- Foliar cover – the estimated total percentage foliar cover for each species recorded
- Height – the average height (in meters) of each species recorded
- Vegetation description – a description of the vegetation according to the National Vegetation Information System (NVIS), Level 5. According to this level, vegetation is classified to 'association', where the dominant growth form, height, cover and species (three species) for the three traditional strata (upper, mid and ground) are described
- Vegetation condition – assessed according to the vegetation condition scale (Environmental Protection Authority, 2016a) and
- Photographs – a photograph from the north west corner looking toward the south east corner was taken.

3.3.2 Flora of Conservation Significance

The Survey Area was traversed on foot and opportunistic collections were made to identify flora of conservation significance which were listed in the Desktop Assessment.

Specimens were collected for identification and lodgement at the Western Australian Herbarium (WAH).

3.3.3 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification using resources of the WAH. Taxonomy was completed by experienced Taxonomist Udani Sirisena at the WA herbarium.

The finalised species list was checked against FloraBase (Department of Biodiversity Conservation and Attractions, 2019b) to determine the species' conservation status and known distribution. Introduced species were compared against the BAM Act Declared Plants list the WONS list to determine their status (Thorp and Lynch, 2000; Department of Energy and Environment, 2018).

3.3.4 Statistical Analyses

All statistics were carried out using RStudio version 3.6.0 (R Studio Team, 2015). Quadrats were classified on the basis of similarity in species composition. Using the results of the observations made in the field, boundaries of the Vegetation Types were finalised on aerial photographs, at a scale of 1:5,000, with the aid of GPS coordinates taken during the field survey. The Vegetation Types were digitised and produced as electronic mapping data using GIS software.

In order to assess the adequacy of the field survey, a species accumulation curve was generated. The species accumulation curve analysed accumulation rates of species identified from the survey. This statistical test can determine if the area been adequately surveyed (species accumulation curves can be useful in estimating total species richness). The accumulation curve was based on presence absence data and the sample order being random with a maximum 999 permutations with four estimator curves (Chao 2, Jacknife 1, Jacknife 2 and Bootstrap) (R Studio Team, 2015). These estimator curves help predict the true total number of species that would be observed as the number of sites tends to infinity.

3.4 Vertebrate Fauna

3.4.1 Field Survey

A level 1 vertebrate fauna survey was undertaken from the 24th to the 26th of July 2019 by qualified Senior Zoologist Andrew Hide. The purpose of the field survey was to verify the accuracy of the desktop assessment and to further delineate and characterise the fauna assemblages and fauna habitat in the Survey Area. The field survey consisted primarily of fauna habitat assessments, systematic bird searches and opportunistic fauna observations. The survey effort is shown in Figure 6.

3.4.2 Fauna Habitat Assessment

Vegetation types and distinctive landforms were used to identify the broad faunal habitats in the Survey Area. These fauna habitats were then assessed for their potential to support species of conservation significance and the quality of habitat they provide to a wider suite of fauna.

A total of nine individual fauna habitat assessments were undertaken throughout the Survey Area. Each habitat assessment recorded the following information which was used in conjunction with aerial imagery to identify and map fauna habitat types:

- Location within the Survey Area (GPS co-ordinate)
- Condition was assessed at the assessment site using the (Environmental Protection Authority, 2016b) vegetation condition scale
- Dominant vegetation and structure (e.g. number of vegetation strata)
- Hollow-bearing trees and dead stags (e.g. average size and abundance of hollows)
- Description of any rock and rocky outcrops
- Logs (e.g. abundance and size)
- Substrate (e.g. leaf litter)
- Wetlands, creeks, rivers, dams and other water bodies
- Description of any observed nests and roosts (if present)
- Subterranean roosts (e.g. caves, disused mineshafts and/or adits)
- Associated fauna species observed using the habitat
- Disturbance (e.g. cattle grazing, fire)
- Photo showing a typical example of the broad fauna habitat type.

3.4.3 Systematic Bird Survey

Systematic bird surveys were undertaken within the Survey Area for 20 minutes in a 2 ha quadrat (Environmental Protection Authority, 2016c) at each fauna habitat assessment location (at a minimum). Where practicable, this was undertaken during typical peak periods of activity when birds are calling and moving about, which is typically in the 3-4 hours of sunrise, particularly during warmer periods.

3.4.4 Opportunistic Observation

Fauna were opportunistically observed and recorded within the Survey Area, which involved targeted searches of habitats that potentially support fauna of conservation significance as well as systematic searches which included looking through leaf litter, overturning rocks, looking under decorticating bark and searches for scats, tracks, burrows and other traces of animals. If conservation significant species were located, the coordinates were geospatially recorded with the Fulcrum mobile application providing accurate GPS locations for each record.

In addition, opportunistic records of fauna species encountered while travelling throughout the Survey Area were documented. Opportunistic data comprises records of fauna species by location and coordinates were taken through the use of the Fulcrum mobile application.

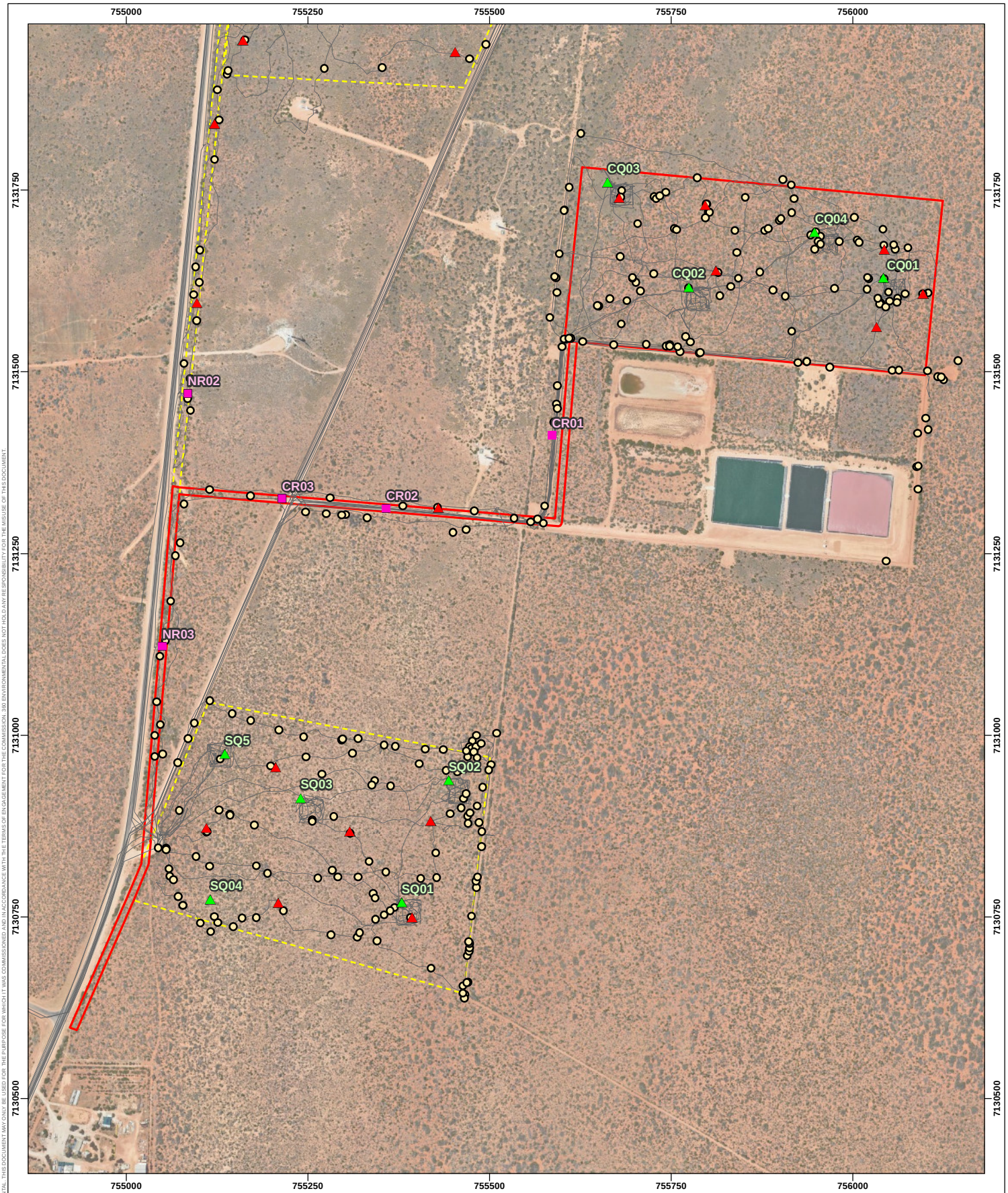
3.4.5 Targeted Malleefowl and Bilby Searches

Malleefowl (*Leipoa ocellata*) and Bilby (*Macrotis lagotis*) leave obvious evidence of current use, in the form of nesting mounds, tracks and signs of the birds (for Malleefowl)

and digging and tracks for Bilby. Therefore, search transects were undertaken throughout the Survey Area, searching for any signs of the species.

3.4.6 Taxonomy

Where there was doubt on species names identified in the desktop assessment (through subsequent name changes or taxonomic reviews), an effort was made to determine the current scientific name for each taxon. Taxonomy and nomenclature in this report follows the WA Museum checklist 2019 (Western Australian Museum, 2019) where relevant.



Legend

- Survey Area
- Water Corporation Site Boundary
- GPS Track
- Flora Quadrat Locations
- Flora Releve Locations
- Fauna Habitat Assessment Locations
- Opportunistic Fauna Locations

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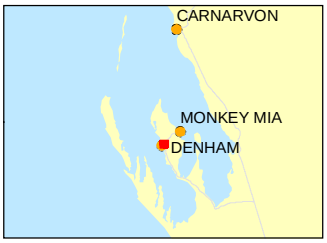
LOCALITY MAP



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Detailed Flora and Fauna Survey

Figure 6 Survey Effort

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4 Results

4.1 Limitations

Limitations and constraints of the flora, vegetation and fauna survey are detailed below in Table 4.

Table 4: Limitations and Constraints Associate with the Survey

Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Availability of Data	Not a limitation	All data required to complete the scope of works including regional and local contextual information was available
Access and Survey Intensity	Not a limitation	The Survey Area was able to be accessed by vehicle and on foot. One releve was undertaken in place of quadrat in order to delineate vegetation within the boundary of the wastewater treatment plant that was unable to be traversed on foot The survey effort is displayed in Figure 6.
Experience	Not a limitation	The flora and vegetation survey was undertaken by Principal Botanist Catherine Krens and Ecologist Colleen McDonald. Catherine has 20 years' experience conducting surveys of similar scope throughout Western Australia, including the Shark Bay region. Colleen has worked as an environmental consultant for two years and has completed flora, vegetation and fauna surveys state-wide. The fauna survey was undertaken by Senior Ecologist Andrew Hide. Andrew has over 12 years' experience conducting fauna surveys of similar scope throughout Western Australia, including the Shark Bay region. Taxonomy was undertaken by experienced Taxonomist Udani Sirisena at the WA herbarium. Specialist taxonomists were consulted regarding specimens of interest, this included R. Davis and T. McFarlane.
Timing, weather, season	Moderate Limitation	The recommended primary survey period for the region as per the EPA Technical Guidance, occurs 6 – 8 weeks post wet season (March – June). However, during the 2019 wet season the region experienced little to no rainfall. Consequently, because there was no break in season the survey was not undertaken during the recommended primary survey period. Instead the survey was undertaken in July 2019 (during the dry season), six weeks after a significant rainfall event (60.4 mm recorded between 7 June and 9 June 2019). This is considered adequate conditions for a supplementary

Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
		survey timing for the Eremaean Botanical Provenance (Environmental Protection Authority, 2016a). Despite being able to complete the survey during a recommended supplementary survey period the area still received below average rainfall for the period leading up to the survey, and this was still not able to be completed during the recommended primary survey period. Therefore, this is considered a moderate limitation of the survey.
Life forms sampled	Moderate limitation	The Survey Area was traversed by foot and all remnant vegetation was surveyed. All dominant flora species were recorded within the vegetation units. Of the 59 flora taxa collected, 10 (17%), were unable to be identified to species level due to the absence of identifiable features such as fruit and flowers. Therefore, this is considered a moderate limitation of the survey. All observable fauna species were identified and recorded, and adequate fauna habitat assessments were completed for the size of the Survey Area.
Completeness	Not a limitation	The survey was considered complete for a detailed flora and vegetation survey, all vegetation types were surveyed and delineated within the Survey Area and a minimum of three quadrats was surveyed for each vegetation type. The survey was considered complete for a level 1 vertebrate fauna survey, with fauna habitat assessments being completed throughout the Survey Area, adequate records of opportunistic fauna, and sampling effort for any potential conservation significant fauna species that may occur within the Survey Area.

4.2 Literature Review

The following reports were reviewed as part of the Literature Review.

Shark Bay Biological Survey: Flora, Vegetation and Fauna Assessment (360 Environmental Pty Ltd, 2018)

360 Environmental was comissioned by Main Roads to undertake a biological survey of potential material extraction areas near Shark Bay and Exmouth, which included a single season flora and vegetation assessment and level 1 vertebrate fauna assessment. The survey comprised three separate areas located within Shark Bay, the closest was located on Shark Bay Road 42 km south/southeast of the Survey Area, and the remaining two were located on Useless Loop Road approximately 80 km south of the Surey Area.

- Four DBCA listed Priority flora species were recorded including: *Olearia occidentissima* (P2), *Lepidium biplicatum* (P3), *Melaleuca huegelii* subsp. *pristicensis* (P3) and *Corchorus congene*r (P3)
- The African Boxthorn (**Lycium ferocissimum*), listed as a WONS was recorded from five locations
- The level 1 vertebrate fauna survey involved three separate Survey Areas in Shark Bay
- No fauna of conservation significance was recorded during the survey (other than a Marine listed Common Tern), however a Malleefowl was observed opportunistically during the vertebrate fauna survey along Useless Loop road.

Flora and Vegetation in the Proposed Coburn Mineral Sand Mine, Hamelin and Meadow Stations, Shark Bay (Mattiske Consulting Pty Ltd, 2005) – Located 84 km southeast of the Survey Area

Mattiske Consulting Pty Ltd was commissioned by URS Australia Pty Ltd to undertake a level 2 flora and vegetation survey in Coburn, Hamelin and Meadow Stations near Shark Bay.

Eighteen natural vegetation communities were mapped within the Survey Area. No TEC or PECs were identified. Nine Priority flora taxa were recorded; *Acacia subrigida, A. drepanophylla, Eremophila occidens, Grevillea rogersoniana and G. stenostachya*, *Jacksonia dendrospinosa, Macarthuria intricata, Physopsis chrysophylla* and *Scholtzia* sp. Folly Hill.

Vertebrate Fauna Survey Coburn Mineral Sand Project (Ninox Wildlife Consulting, 2005) – Located 84 km southeast of the Survey Area

Ninox Wildlife Consulting was commissioned by URS Australia Pty Ltd to undertake a Level 2 vertebrate fauna survey in Coburn, Hamelin and Meadow Stations near Shark Bay.

The level 2 vertebrate fauna survey comprised three separate surveys undertaken in September 2003, April 2004 and October 2004 and involved 19 sampling locations, located 84 km southeast of the curent Survey Area. Malleefowl was detected during the survey.

No other fauna of conservation significance was recorded during the three surveys.

Public Environmental Review Coburn Mineral Sand Mine (URS Australia Pty Ltd, 2005) – Located 84 km southeast of the Survey Area

The report provides additional information relevant to the above mentioned reports.

Project Eden Fauna Recovery on Peron Peninsula, Shark Bay: Western Shield (Morris et al., 2004) – Located 5 to 30 km north of the Survey Area

A number of native fauna reintroductions were undertaken by the then Department of Parks and Wildlife (now DBCA), as part of Project Eden. The reintroductions occurred within Francois Peron National Park, approximately 10 – 40 km north of the Survey Area.

The species that were reintroduced included Malleefowl (*Leipoa ocellata*), Woylie (*Bettongia penicillata*), Greater bilby (*Macrotis lagotis*), Banded hare-wallaby (*Lagostrophus fasciatus*), Rufous hare-wallaby (*Lagorchestes hirsutus*) and Quenda (*Isoodon obesulus*).

Only two of the six species established viable populations in the Malleefowl and Bilby.

Vegetation and Rare Flora Surveys Concept Development Plan Areas Monkey Mia Dolphin Resort, Shire of Shark Bay (Weston, 2002)

During the survey no Declared Rare or Priority flora species were recorded in either study area. The study area is located 20 km northeast of the current Survey Area.

4.3 Flora and Vegetation

4.3.1 Desktop Assessment

The desktop assessment identified 37 conservation significant species occurring within 50 km of the Survey Area. This included:

- One Threatened species
- Five Priority 1 species
- 14 Priority 2 species
- 14 Priority 3 species
- Three Priority 4 species.

A full description of all conservation significant species identified in the Desktop Assessment is provided in Appendix A and their locations are mapped in Figure 7.

The desktop assessment identified one Priority Ecological Community listed by the State occurring within 20 km of the Survey Area (Figure 8). The Hypersaline microbial community number 2 is listed as a Priority 1 under the State legislation however the PEC is not listed under the EPBC Act.

4.3.2 Likelihood of Occurrence

The conservation significant species identified in the Desktop Assessment were reviewed for their likelihood of occurrence within the Survey Area based on the criteria outlined in Table 3. Of the 37 species identified in the desktop assessment, three species were recorded or potentially recorded within the Survey Area, nine species are considered to have a high likelihood of occurrence, 12 are considered to have a medium likelihood of occurrence and 13 are considered to have a low likelihood of occurrence. The likelihood assessment is displayed in Table 5.

Priority species identified as having been recorded or potentially recorded in the Survey Area include:

- *Acanthocarpus* aff. *rupestris* (P2)
- *Olearia ?occidentissima* (P2)
- *Triodia plurinervata* (P3).

Priority species identified as having a high likelihood of occurrence in the Survey Area include:

- *Abutilon* sp. Hamelin (A.M. Ashby 2196) (P1)
- *Chthonocephalus muellerianus* (P2)
- *Chthonocephalus tomentellus* (P2)
- *Melaleuca oldfieldii* (P2)
- *Acanthocarpus parviflorus* (P3)
- *Anthocercis intricata* (P3)
- *Bossiaea calcicola* (P3)
- *Grevillea rogersoniana* (P3)
- *Physopsis chrysophylla* (P3).

Priority species identified as having a medium likelihood of occurrence in the Survey Area include:

- *Eucalyptus beardiana* (T, VU)
- *Eremophila splendens* (P1)
- *Abutilon* sp. Quobba (H. Demarz 3858) (P2)
- *Adenanthos acanthophyllus* (P2)
- *Ptilotus alexandri* (P2)
- *Scaevola chrysopogon* (P2)
- *Thryptomene repens* (P2)
- *Lepidium biplicatum* (P3)
- *Macarthuria intricata* (P3)
- *Melaleuca huegelii* subsp. *pristicensis* (P3)
- *Phyllanthus fuernrohrii* (P3)
- *Triodia bromoides* (P4).

The remaining 14 species were considered to have a low likelihood of occurrence in the Survey Area.

Legend

- Survey Area

DBCA Threatened and Priority Flora Locations

- *Abutilon* sp. *Hamelin* (A.M. Ashby 2196) (P2)
- *Acacia drepanophylla* (P3)
- *Angianthus microcephalus* (P2)
- *Chthonocephalus tomentellus* (P2)
- *Eremophila splendens* (P1)
- *Grevillea rogersoniana* (P3)
- *Lepidium biplicatum* (P3)
- *Melaleuca huegelii* subsp. *pristicensis* (P3)
- *Olearia occidentissima* (P2)
- *Ptilotus alexandri* (P2)
- *Sondottia glabrata* (P2)
- *Thryptomene repens* (P2)
- *Triodia bromoides* (P4)
- *Triodia plurinervata* (P3)
- Other

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LOCALITY MAP

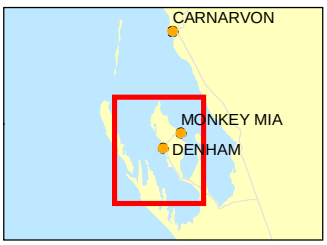

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Figure 7 DBCA Threatened and Priority Flora Locations

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Legend

Survey Area

Threatened and Priority Ecological Communities (20km Buffer)

Hypersaline microbial community number 2 (Priority 1)

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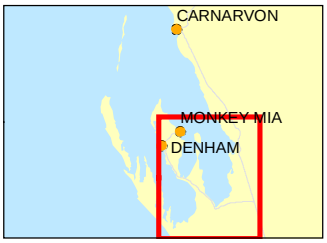

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Figure 8 **DBCA Threatened and Priority Ecological Communities**

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Table 5: Flora Likelihood of Occurrence

Closest record to Survey Area based on DBCA 2019. High = Suitable habitat present and records less than 15 km from the Survey Area, Medium = Suitable habitat present and records between 15 km and 50 km from the Survey Area, and Low = No suitable habitat present and/or records greater than 50 km from the Survey Area. CR = Listed as Critically Endangered under the EPBC Act, EN = Listed as Endangered under the EBPC Act, VU = Listed as Vulnerable under the EPBC Act .

Species	Conservation Status		Source	Distance to Nearest Record (km)	Flowering Period	Prefered Habitat	Habitat occurs within the Survey Area	Likelihood of Occurrence
	DBCA	EPBC	NatureMap					
Eucalyptus beardiana	T	VU		66.4	Aug to Sep	Red or yellow sand. Sand dunes & ridges.	Yes	Medium
Boronia crenulata subsp. Shark Bay (G. Cockerton	P1	-		26.8	Aug	Limestone. Outcrop.	No	Low
Dicrastylis sp. Denham (M. Lewis 42/92)	P1	-	X	15.2	-	Grey Sand.	No	Low
Eremophila cuneata	P1	-		43.9	-	Below limestone outcrop.	No	Low
Eremophila splendens	P1	-		42.7	Sep	Creamy brown calcareous sand. Slopes, lowland	Yes	Medium
Grevillea sp. Shark Bay (N.H. Speck 24/09/1953)	P1	-	X	1.3	Unknown	Unknown	-	Low
Abutilon sp. Hamelin (A.M. Ashby 2196)	P2	-	X	1.4	Jul to Sep	Sand or loam. Limestone rises.	Yes	High
Abutilon sp. Quobba (H. Demarz 3858)	P2	-	X	14.9	Jul to Sep	Sandplain, brown clayey sand or rock.	Yes	Medium
Acanthocarpus rupestris	P2	-		28.2	May to Jun	Red sand, limestone.	Yes	Recorded
Adenanthos acanthophyllus	P2	-		44.5	Apr to Jul or Dec	Red or orange-brown sand.	Yes	Medium
Angianthus microcephalus	P2	-		33.2	Sep to Dec	Sandy or clayey soils. Salt swamps &andpans.	No	Low
Calandrinia sp. Edel Land (F. Obbens FO 01/17)	P2	-		39.6	-	Rocky limestone outcrop on hilltop. Grey brown sandy loam in rock cracks etc. over limestone.	No	Low
Chthonocephalus muellerianus	P2	-	X	1.3	Sep	Red sand.	Yes	High
Chthonocephalus tomentellus	P2	-	X	8.9	Aug to Nov	Red sand. Undulating plains, sand dunes, near saline depressions.	Yes	High
Melaleuca oldfieldii	P2	-	X	2.3	Aug or Oct to Dec	Red or brown sand over sandstone or limestone, sandy clay.	Yes	High
Olearia occidentissima	P2	-	X	0	Jul to Sep	Shallow soils. Coastal limestone cliffs.	Yes	Possibly Recorded
Ptilotus alexandri	P2	-		28.2	Aug to Oct	Red-white sand. Dunes.	Yes	Medium
Scaevola chrysopogon	P2	-		46.2	Aug to Oct	Red/brown sand. Sandplains.	Yes	Medium
Sondottia glabrata	P2	-	X	1.9	Sep to Oct	Saline flats.	No	Low
Thryptomene repens	P2	-		39.0	-	High part of dune; creamy-brownish calcareous sand.	Yes	Medium
Acacia drepanophylla	P3	-	X	14.2	May to Jul	Red clay or loam over limestone. Flat to undulating plains, low rises.	No	Low
Acanthocarpus parviflorus	P3	-	X	1.3	May to Jun	Sand over limestone or sandstone.	Yes	High
Anthocercis intricata	P3	-	X	1.4	Jun to Sep	Sand or loam over limestone. Consolidated sand dunes.	Yes	High
Bossiaea calcicola	P3	-	X	1.3	Jul to Sep	Compacted sand over limestone. Exposed sites on coastal cliffs and slopes.	Yes	High
Carpobrotus sp. Thevenard Island (M. White 050)	P3	-		40.9	Aug	Coarse white sand. Dune tops, disturbed areas.	No	Low
Grevillea rogersoniana	P3	-	X	1.3	Aug to Oct	Red sand.	Yes	High
Lepidium biplicatum	P3	-	X	18.9	Sep	Coastal regions.	Yes	Medium
Macarthuria intricata	P3	-		44.5	Sep to Dec	Red or black soil over limestone, grey sand over sandstone, sandy clay. Sandplains & sand dunes.	Yes	Medium
Melaleuca huegelii subsp. pristicensis	P3	-		26.8	Sep to Oct	Sand.	Yes	Medium
Phyllanthus fuernrohrii	P3	-		39.8	-	Red soil over limestone.	Yes	Medium
Physopsis chrysophylla	P3	-	X	1.3	Sep to Dec or Jan	Red or yellow sandy soils. Sandplains.	Yes	High
Spergularia nesophila	P3	-		37.8	-	Brown guano soil over limestone rock. Rock platform off high rock island.	No	Low
Stenanthemum divaricatum	P3	-	X	1.3	-	White or yellow sand over sandstone.	No	Low
Triodia plurinervata	P3	-	X	1.4	May to Jul or Sep to Oct	Red to orange-brown sand, limestone, sandy loam. Sand dunes & steppes, often coastal areas, drainage basins, salt lakes.	Yes	Recorded
Eucalyptus zopherophloia	P4	-	X	15.8	Oct to Dec or Jan	Grey/white sand with limestone rubble. Coastal areas.	No	Low
Lepidium puberulum	P4	-		41.5	Jul to Aug or Oct to Nov	Sandy soils.	No	Low
Triodia bromoides	P4	-		35.7	Jul to Oct	Red, grey and calcareous sand. Dunes, sandplains, stony rises.	Yes	Medium

4.3.3 Flora

The survey recorded a total of 59 taxa from 45 genera across 29 families. The most dominant families were Fabaceae (seven species) and Chenopodiaceae (seven species) and the most dominant genera was *Acacia* (four species). A full species inventory is detailed in Appendix B.

A specimen was collected for all species recorded within the Survey Area. A large proportion of flora, 10 taxa (17%), were unable to be identified confidently to species level. This was mainly due to the specimens being sterile with no flowering material or fruit present.

All recorded flora was common to the Carnarvon region and none of the flora represented a population range extension.

4.3.4 Flora of Conservation Significance

The targeted flora survey focused on areas of suitable habitat for species with a medium or high likelihood of occurrence within the Survey Area (Table 5).

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded during the survey.

Two Priority species as listed by DBCA (*Acanthocarpus* aff. *rupestris* (P2) and *Triodia plurinervata* (P3)) were recorded within the Survey Area and one potential Priority species (*Olearia*? *occidentissima* (P2)) was recorded within the Survey Area. *T. plurinervata* was recorded in all four quadrats across the Survey Area. *Acanthocarpus* aff. *rupestris* and *Olearia*? Occidentissima were recorded in three of the four quadrats.

4.3.5 Introduced Flora

A total of five introduced species were recorded or potentially recorded within the Survey Area, representing 8.6% of the total taxa recorded (Table 6). None of these are listed as Declared Pests under the Bam Act (Department of Primary Industries and Regional Development, 2018). One species, **Lycium ferocissimum* is listed as a WONS (Department of Energy and Environment, 2018).

Table 6: Introduced Flora Species within the Survey Area

Species	Common Name	Status under BAM Act	WONS
**Hypochaeris glabra*	Smooth Cats-ear	Permitted – s11	No
**Lycium ferocissimum*	African Boxthorn	Permitted – s11	Yes
**Sonchus oleraceus*	Common Sowthistle	Permitted – s11	No
?**Sisymbrium erysimoides*	Smooth Mustard	Permitted – s11	No

Species	Common Name	Status under BAM Act	WONS
?*Urospermum picroides	False Hawkbit	Permitted – s11	No

4.3.6 Vegetation Types

A total of three vegetation types were mapped within the Survey Area. These consisted of:

- AlTdTp= *Triodia* Hummock Grassland (12.51 ha)
- AlCrAp = *Acacia* Shrubland (0.35 ha)
- AlTdAp = Myrtaceae Low Shrubland (0.74 ha).

The vegetation units are described in Table 7 and mapped in Figure 9. Detailed site sheets for each quadrat are provided in Appendix C.

Table 7: Vegetation Types Occurring within the Survey Area

Broad Floristic Formation	Vegetation Unit		Sites	Photograph
Triodia Hummock Grassland	AlTdTp	Mid Open Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over a Low Open Shrubland of *Chorizema racemosum*, *Melaleuca eulobata* and *Thryptomene dampieri* over a Low Open Hummock Grassland of *Triodia plurinervata*. Representation in the Survey Area: 12.51 ha; 92.4%	Q01, Q02, Q03, Q04, MN04	
Acacia Shrubland	AlCrAp	Mid Sparse Shrubland of *Acacia ligulata* over Low Sparse Shrubland of *Chorizema racemosum* and *Stylobasium spathulatum*, Low Sparse Chenopod Shrubland over *Atriplex paludosa*. Representation in the Survey Area: 0.35 ha; 2.6 %	R01, MN01, MN02	

Broad Floristic Formation	Vegetation Unit		Sites	Photograph
Myrtaceae Low Shrubland	AlTdAp	Mid Sparse Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over a Low Open Shrubland of *Acacia tetragonophylla*, *Scaevola spinescens* and *Thryptomene dampieri* over a Low Sparse Chenopod Shrubland of *Atriplex paludosa* and *Rhagodia latifolia*. Representation in the Survey Area: 0.74 ha; 4.97%	MN01	
Track	Track	Cleared existing track. Representation in the Survey Area: 0.07 ha; 0.50%	MN03	-

4.3.7 Vegetation Condition

Vegetation condition within the Survey Area ranged from Excellent to Completely Degraded. The majority of the Survey Area was in Excellent condition (81.46%). Disturbances included litter and weeds. In summary, condition across the Survey Area consisted of:

- Excellent: 9.13 ha, 67.4%
- Very Good: 3.52 ha, 26.0%
- Good: 0.14 ha, 1.0%
- Degraded: 0.03 ha, 0.2%
- Completely Degraded (cleared areas): 0.73 ha, 5.4%

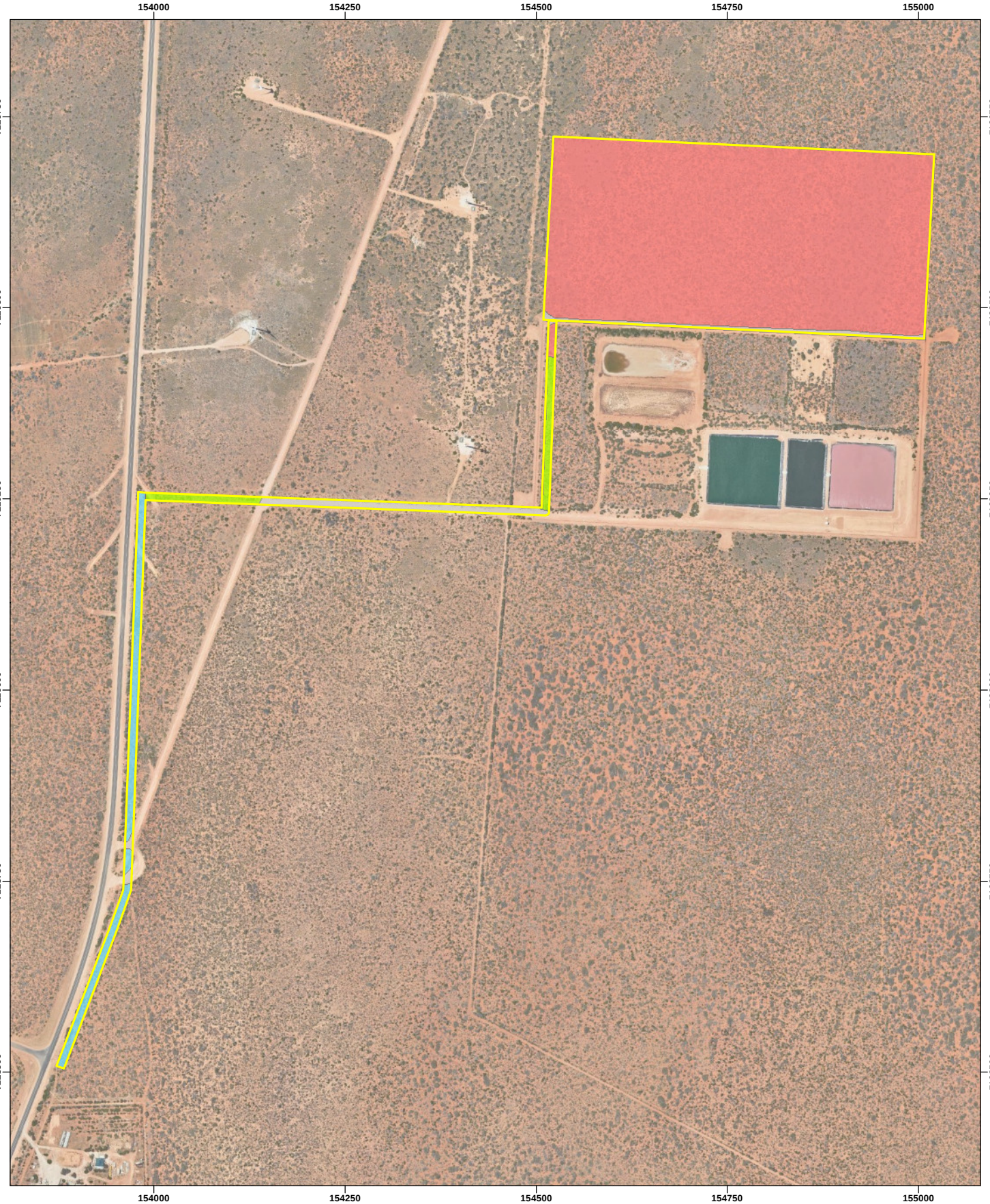
The vegetation condition is mapped in Figure 10.

4.3.8 Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were present within the Survey Area.

4.3.9 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1976) and Shepherd et al. (2002) broad vegetation types by examining similarities in vegetation descriptions. Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale). Vegetation type AlTdTp is considered to be representative of the Perron 112 vegetation types which includes 92.4 % of the Survey Area.



Legend

- Survey Area

Vegetation Types

- C1a - AlTdTp
- C2a - AlCrAp
- S1a - AlTdAp
- Track

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- OTHER DATA SOURCED LANDGATE 2019

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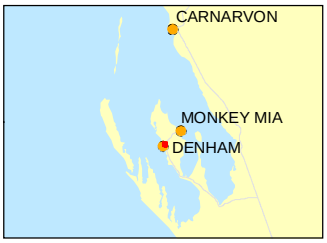
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



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Horizon Power
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Detailed Flora and Fauna Survey

Figure 9 Vegetation Types

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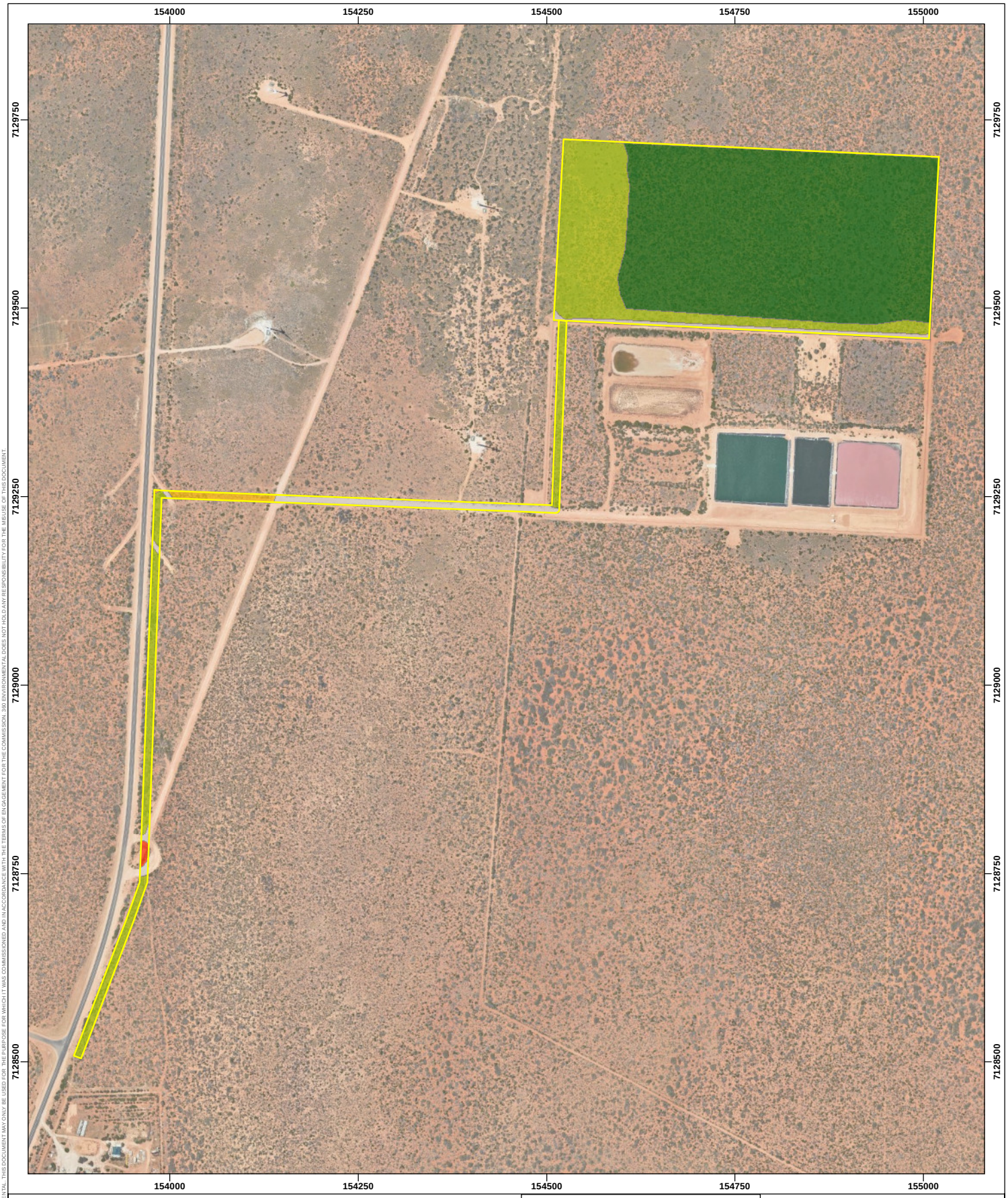

Legend

- Survey Area

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

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- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

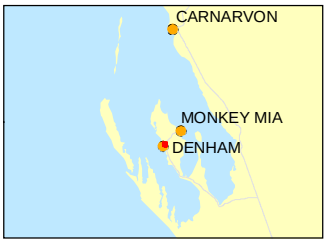

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Figure 10
Vegetation Condition

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4.4 Vertebrate Fauna Results

4.4.1 Desktop Assessment

A total of 213 vertebrate fauna species were retrieved from the database searches. Of these, 37 are conservation significant vertebrate fauna species (including Priority species) from 15 families.

The results of the DBCA fauna database search are displayed in Figure 11 and the results of all database searches are presented in Appendix A.

The following are a summary of the key findings from the fauna database searches:

- 134 bird species have been previously recorded in the surrounding area, including 31 species of conservation significance
- 14 mammal species have been previously recorded in the surrounding area, including three species of conservation significance
- 65 reptile species have been previously recorded in the surrounding area, including three species of conservation significance
- No amphibian species have been previously recorded in the surrounding area, and therefore there are no species of conservation significance.

Species listed as Marine only under the EPBC Act, such as the Black-faced Cuckoo-shrike (*Coracina novaehollandiae*), Rainbow Bee-eater (*Merops ornatus*), Australian Kestrel (*Falco cenchroides*) etc, as well as marine dependent species including the Dugong (*Dugong dugon*), Dolphin spp. and Albatross spp. have been excluded from the likelihood of occurrence list as there is no marine habitat present within the Survey Area.

4.4.2 Field Survey

A total of 40 terrestrial vertebrate fauna species from 29 families were recorded during the field survey (15 of which were recorded outside of the Survey Area), comprised of:

- 26 bird species from 18 families
- 10 mammal species from eight families
- Six reptiles from three families.

A full systematic fauna species list is presented below in Table 8, which lists the total count of species records (providing a rough indication of abundance), and conservation status. Species recorded outside the Survey Area were all observed within 2 km of the Survey Area.

A total of seven introduced fauna species were recorded within the Survey Area (all mammals). Seven Marine Listed species were recorded.

Table 8: Fauna Species Recorded During the Field Survey

Family	Scientific Name	Common Name	Conservation Status		Survey Area Count	
			State	Federal	Inside	Outside
Aves						
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren			4	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle			-	1
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle		MA	-	2
Anatidae	*Anas gracilis*	Grey Teal			-	20
Anatidae	*Tadorna tadornoides*	Australian Shelduck (Mountain Duck)			-	3
Cacatuidae	*Cacatua roseicapilla*	Galah			-	26
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		MA	-	2
Columbidae	*Spilopelia senegalensis*	Laughing Turtle-Dove			2	3
Corvidae	*Corvus bennetti*	Little Crow			-	2
Corvidae	*Corvus orru*	Torresian Crow			-	1
Dromaiidae	*Dromaius novaehollandiae*	Emu			15	28
Estrildidae	*Taeniopygia guttata*	Zebra Finch			13	10
Falconidae	*Falco berigora*	Brown falcon			1	
Falconidae	*Falco cenchroides*	Australian Kestrel (Nankeen Kestrel)		MA	2	2
Hirundinidae	*Hirundo neoxena*	Welcome Swallow			-	34
Hirundinidae	*Petrochelidon nigricans*	Tree Martin		MA	15	6
Laridae	*Larus novaehollandiae*	Silver Gull		MA	-	5
Maluridae	*Malurus lamberti*	Variegated Fairy-wren			19	8
Maluridae	*Malurus leucopterus*	White-winged Fairy-wren			11	25
Meliphagidae	*Gavicalis virescens*	Singing Honeyeater			17	19
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		MA	-	1
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler			2	3
Psophodidae	*Psophodes occidentalis*	Western Wedgebill (Chiming Wedgebill)			6	4
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		MA	-	2
Mammalia						
Bovidae	*Capra hircus*	Goat *			8	3
Canidae	*Canis familiaris dingo*	Dingo, Dog *			1	8
Canidae	*Vulpes vulpes*	Red Fox *			1	4
Equidae	*Equus caballus*	Horse *			2	
Felidae	*Felis catus*	Cat *			3	4

Family	Scientific Name	Common Name	Conservation Status		Survey Area Count	
			State	Federal	Inside	Outside
Leporidae	*Oryctolagus cuniculus*	Rabbit *			21	18
Macropodidae	*Osphranter robustus erubescens*	Euro			15	23
Muridae	*Mus musculus*	House Mouse *			2	3
Muridae	*Notomys alexis alexis*	Spinifex Hopping-mouse			8	6
Tachyglossidae	*Tachyglossus aculeatus acanthion*	Short-beaked Echidna			4	5
Reptilia						
Agamidae	*Ctenophorus maculatus maculatus*	Spotted Military Dragon			12	16
Pygopodidae	*Delma sp.*	Delma sp.			-	1
Scincidae	*Cryptoblepharus plagiocephalus*	Peron's Snake-eyed Skink			2	2
Scincidae	*Lerista sp.*	Lerista			2	6
Scincidae	*Morethia butleri / obscura*	Morethia			-	1
Scincidae	*Tiliqua rugosa palarra*	Bobtail			-	3

* Introduced species

MA = Marine Listed Species

4.4.3 Fauna Habitat

A total of seven fauna habitat assessments were undertaken during the field survey, with three fauna habitat types identified and mapped (Figure 12, Appendix D), which includes *Acacia* Shrubland, over *Triodia*, *Acacia* Shrubland (*Triodia* absent) and Cleared/Completely Degraded. The extent of fauna habitats within the Survey Area are presented in Table 9 and a description and photo for each are presented in Table 10.

Table 9: Fauna Habitat Types and Extent within the Survey Area

Fauna Habitat	Extent within Survey Area	
	Area (ha)	%
Acacia Shrubland	9.55	70.5
Acacia Shrubland, over *Triodia*	3.37	24.9
Cleared/Completely Degraded	0.62	4.6
Total Area	**947**	**100**

Table 10: Fauna Habitat Type Descriptions with the Survey Area

Fauna Habitat	Vegetation Type Code	Fauna Habitat Description and Fauna Value	Representative Photo
Acacia Shrubland	AlTdTp AlTdAp AlCrAp	Open *Acacia* and *Exocarpos* Shrubland, over *Acacia*, *Thryptomene*, *Chorizema*, *Melaleuca* and mixed shrubs. This fauna habitat provides breeding and foraging refuge to fauna, particularly small terrestrial birds and reptiles, utilising the shrubs.	
Acacia Shrubland, over *Triodia*	AlTdTp	Open *Acacia* and *Exocarpos* Shrubland, over *Acacia*, *Thryptomene*, *Chorizema*, *Melaleuca* and mixed shrubs, over *Triodia.* This fauna habitat provides breeding and foraging refuge to fauna, particularly small terrestrial birds and reptiles, utilising the shrubs, as well as the added benefit of the *Triodia* for cover.	
Cleared/Completely Degraded	-	This fauna habitat type contains limited vegetation and has recently or previously been cleared or heavily disturbed. Provides low to no fauna value.	

4.4.4 Conservation Significant Fauna

No fauna species of conservation significance (Threatened or Priority), or evidence of these species such as tracks, scats, nest, diggings, burrows or direct sightings were recorded within or directly surrounding the Survey Area.

Targeted searches for Malleefowl, Bilby and additional conservation significant species were undertaken by traversing the Survey Area (as displayed in Figure 6). These searches did not identify any evidence of any conservation significant species.

4.4.4.1 Likelihood of Occurrence

The 37 conservation significant fauna species identified from the desktop assessment were further assessed for their likelihood of occurrence after the completion of the field survey (Table 11). The results determined that:

- No fauna species of conservation significance were recorded within the Survey Area
- Two conservation significant fauna species are considered to have a high likelihood of occurrence within the Survey Area, and includes:
    - Osprey (*Pandion haliaetus*) – Migratory/Marine
    - Western Grasswren (*Amytornis textilis textilis*) – Priority 4.
- Eight conservation significant fauna species are considered to have a medium likelihood of occurrence within the Survey Area. This includes four marine/coastal birds, as well as the following three terrestrial species:
    - Pacific Swift (*Apus pacificus*) – Migratory/Marine
    - Malleefowl (*Leipoa ocellata*) – Vulnerable
    - Bilby (Macrotis lagotis) – Vulnerable
    - Woma (*Aspidites ramsayi*) – Priority 1 (South West Population)
- The remaining 27 conservation significant species are considered to have a low likelihood of occurrence.

TABLE 11: Fauna Likelihood of Occurrence

Key: STATE = Biodiversity Conservation Act 2016 or Department of Biodiversity, Conservation and Attractions Conservation Code, FEDERAL = Environmental Protection and Biodiversity Conservation Act 1999, A = Listed in Naturemap Search, B = EPBC Protected Matters Search, C = DBCA Threatened and Priority Fauna Search, D = Current Survey, # = Number of DBCA Records in Past 15 years

CR = Critically Endangered, EN = Listed as Endangered, VU = Listed as Vulnerable, IA = International Agreement, Mi = Listed as Migratory, CD = Conservation dependent fauna, OS = Other specially protected fauna under the WC Act, Ma = Listed as Marine under the EBPC Act, P = Listed as Priority by the DBCA.

FAMILY	SCIENTIFIC NAME	COMMON NAME	CONSERVATION CODES STATE	FEDERAL	A	B	C	D	#	HABITAT PREFERENCE	LIKELIHOOD OF OCCURRENCE
AVIAN (MARINE / COASTAL)											
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	IA (& VU at subsp. level)	VU, MI & MA	X	X	X		9	Tidal flats, preferring sandy substrates where it mainly forages for small crustaceans. Roosts on beaches at high tide, usually in association with other small waders, but more tolerant of hot dry sand[1]	Low
Charadriidae	*Charadrius mongolus*	Lesser Sand Plover	EN & IA	EN, MI & MA	X	X			6	Tidal flats, tolerates muddy substrates[1]	Low
Charadriidae	*Pluvialis squatarola*	Grey Plover	IA	MI & MA	X		X		10	Strictly coastal, restricted ot large tidal flat systems[1]	Low
Hydrobatidae	*Oceanites oceanicus*	Wilson's Storm Petrel	IA	MI & MA	X				1	One of the world's most abundant sebirds. Circumpolar, breeding in summer mostly Antartic continent [1]	Low
Laridae	*Sterna anaethetus*	Bridled Tern	IA	MI & MA	X		X		1	Sea-tern of tropical and sub-tropical waters. Forages far offshore, alone or in loose flocks [1]	Low
Laridae	*Sterna bergii*	Crested Tern (Greater Crested Tern)	IA	MI & MA	X				-	Coastal - ocean beahces, offshore islands, extending out to the deeper pelagic waters; inshore on estuaries, bays, harbours, coastal lagoons; inland on major rivers, occasionally on saline lakes, salt ponds near coast[2]	Medium
Laridae	*Sterna caspia*	Caspian Tern	IA	MI & MA	X		X		21	Occurs in sheltered coastal waters; also uses inland water bodies, including large rivers, fresh to saline lakes, reservoirs and temporary wetlands[1]	Medium
Laridae	*Sterna dougallii*	Roseate Tern	IA	MI & MA			X		-	Restricted to tropical and subtropical seas and coastlines, mainly associated with coral reefs and sparsely vegetated islands where colonies usually nests on beahes just above high water mark[1]	Medium
Laridae	*Sterna hirundo*	Common Tern	IA	MI & MA	X				2	Migrant from N Asia breeding grounds, adults occur in Aust from Sept to April. Coastal foraging in near-shore waters from sheltered bays to beyond surf point [1]	Medium
Pandionidae	*Pandion haliaetus*	Osprey		MI & MA	X		X		5	Coastal waters and estuaries, beaches islets and reefs - but usually not far out to sea except on islets or exposed reefs. Follows major rivers and wetlands far inland from the coast to larger river pools, even to arid regionswhere large pools occur in gorges hundreds of kilometres inland[2]	High
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	IA	MI & MA	X		X		1	Broad range of coastal habitats, including tidal flats, ocean beaches and rocky shorelines[1]	Low
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	IA	MI & MA	X		X		1	Fresh or salt wetlands – muddy edges of lagoons, swaps, lakes, dams, soaks, sewage farms, temporary floodwaters[2]	Low
Scolopacidae	*Calidris alba*	Sanderling	IA	MI & MA	X		X		1	Ocean beaches and sandy tidal flats[1]	Low
Scolopacidae	*Calidris canutus*	Red Knot	IA (& VU at subsp. level)	EN, MI & MA	X		X		3	Restricted to coastal sites with extensive, firm tidal flats[1]	Low

[1] = (Menkhorst et al., 2017), [2] = (Morcombe, 2003), [3] = (Wilson and Swan, 2017), [4] = (Van Dyck and Strahan, 2008)

FAMILY	SCIENTIFIC NAME	COMMON NAME	CONSERVATION CODES STATE	FEDERAL	A	B	C	D	#	HABITAT PREFERENCE	LIKELIHOOD OF OCCURRENCE
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	VU & IA	CR, MI & MA	X	X	X		2	Inter-tidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes[2]	Low
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	IA	MI & MA	X		X		13	Diverse – tidal and inland on mudflats, salt marshes, beaches, salt fields, temporary floodwaters[2]	Low
Scolopacidae	*Calidris tenuirostris*	Great Knot	VU & IA	CR, MI & MA	X	X	X		7	Restricted to large tidal-flat systems, typically follow tide edge when foraging. At high tide gather with other shore birds on beaches or open sites with a damp substrate[1]	Low
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	IA (& VU at subsp. level)	MI (& VU or CR at subsp. level) & MA	X		X		17	Coastal sites with large tidal flats[1]	Low
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	IA	MI & MA	X		X		5	Shallow inland wetlands and, specially before wet season rains begin, on coast. Prefer sites with muddy substrates[1]	Low
Scolopacidae	*Numenius madagascariensis*	Far Eastern Curlew (Eastern Curlew)	VU & IA	CR, MI & MA	X	X	X		1	Widespread but patchily distributed along coast, most numerous at sites with extensive tidal flats[1]	Low
Scolopacidae	*Numenius phaeopus*	Whimbrel	IA	MI & MA	X		X		1	Widespread along Australian coast, but more common in north, especially at sites with combination of large tidal flas and mangroves[1]	Low
Scolopacidae	*Tringa brevipes*	Grey-tailed Tattler	IA & P4	MI	X	X	X		8	Coastal in Australia, most numerous on large tidal flat systems, but some use rocky shorelines[1]	Low
Scolopacidae	*Tringa cinerea*	Terek Sandpiper	IA	MI & MA	X		X		1	Preferring large tidal-flat systems[1]	Low
Scolopacidae	*Tringa glareola*	Wood Sandpiper	IA	MI & MA	X		X		4	Uses freshwater wetlands, especially those with emergent sedges and taller fringing vegetation[1]	Low
Scolopacidae	*Tringa hypoleucos*	Common Sandpiper	IA	MI & MA	X		X		15	Varied coastal and interior wetlands – narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches; avoids wide open mudflats. Perches on branches, posts, boats[2]	Low
Scolopacidae	*Tringa nebularia*	Common Greenshank	IA	MI & MA	X		X		16	Diverse inland and coastal spots. Away from the coast - uses both permanent and temporary wetlands – billabongs, swamps, lakes, floodplains, sewage farms and salt works ponds, flooded irrigated crops. On the coast – uses sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. Prefers wet and flooded mud and clay rather than sand[2]	Low
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	IA	MI & MA	X				2	Shallow, fresh to brackish inland wetlands[1]	Low
AVIAN (TERRESTRIAL)											
Acanthizidae	*Calamanthus campestris*	Dirk Hartog Island Rufous Fieldwren	VU		X	X			-	Occurs in low, sparse to dense shrublands, from temperate to arid regions. Charactieristic of chenopod shrublands and samphire, also in Mallee heathlands and has been recorded in Triodia Grasslands and dwarff mangroves [1]	Low
Apodidae	*Apus pacificus*	Pacific Swift (Fork-tailed Swift)	IA	MI & MA			X		-	Low to very high airspace over varied habitat, rainforest to semi-desert[2]	Medium
Maluridae	*Amytornis textilis textilis*	Western Grasswren	P4		X	X			21	In the Shark Bay region, the species prefers Acacia shrubland with dense shrub clumps and lower recumbent shrubs in which foliage extends to the ground [1]	High

[1] = (Menkhorst et al., 2017), [2] = (Morcombe, 2003), [3] = (Wilson and Swan, 2017), [4] = (Van Dyck and Strahan, 2008)

FAMILY	SCIENTIFIC NAME	COMMON NAME	CONSERVATION CODES STATE	FEDERAL	A	B	C	D	#	HABITAT PREFERENCE	LIKELIHOOD OF OCCURRENCE
Megapodiidae	*Leipoa ocellata*	Malleefowl	VU	VU	X	X	X		9	Unburned mallee and woodland with abundant litter and low scrub[2]	Medium
MAMMALIAN											
Dasyuridae	*Dasyurus geoffroii fortis*	Western Quoll, Chuditch	VU	VU	X	X	X		1	Areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland[4]	Low
Potoroidae	*Bettongia penicillata ogilbyi*	Brush-tailed Bettong, Woylie	CR	EN	X	X	X		-	Restricted to three small wheatbelt reserves, all characterised by the presence thickets of the plant genus Gastrolobium[4]	Low
Thylacomyidae	*Macrotis lagotis*	Bilby, Dalgyte	VU	VU	X	X	X		1	Variety of inland habitats including Mitchell Grass and stony downs country of cracking clays, desert sandplains and dune fields sometimes containing laterite, with hummock grassland and massive red earths with Acacia shrubland[4]	Medium
REPTILIAN											
Pygopodidae	*Pletholax gracilis edelensis*	Keeled Legless Lizard (Shark Bay)	P3		X	X			-	Restricted to Edel Land Peninsula and Dirk Hartog Island, Shark Bay on dunes with Beach Spinifex (Spinifex longifolius) and brown loam supporting Triodia [3]	Low
Pythonidae	*Aspidites ramsayi*	Woma	P1 (southwest population)		X	X			1	The Woma occurs within woodlands, heaths and shrublands, often with spinifex. It shelters mainly in abandoned monitor and mammal burrows and in soil cracks [3]	Medium
Scincidae	*Egernia stokesii badia*	Western Spiny-tailed Skink	VU	EN	X	X	X		-	Occupies rock crevices and hollow timber in sw. interior of WA and on Dirk Hartog Is., Shark Bay[3]	Low

[1] = (Menkhorst et al., 2017), [2] = (Morcombe, 2003), [3] = (Wilson and Swan, 2017), [4] = (Van Dyck and Strahan, 2008)

Legend

- Survey Area

DBCA Threatened and Priority Fauna Locations

- Bilby, dalgyte, ninu (VU)
- Chuditch, western quoll (VU)
- Dirk Hartog Island rufous fieldwren (VU)
- Keeled legless lizard (Shark Bay) (P3)
- Osprey, Eastern Osprey (IA)
- Malleefowl (VU)
- Western grasswren (P4)
- Western spiny-tailed skink (VU)
- Woma (southwest subpop.) (P1)
- Woylie, brush-tailed bettong (CR)
- Marine Birds

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0 2,200 4,400 6,600
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Figure 11 DBCA Threatened and Priority Fauna Locations

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Legend

- Survey Area
- Fauna Habitat Assessment Locations

Fauna Habitat

- Acacia Shrubland
- Acacia Shrubland, over Triodia
- Cleared/Completely Degraded

- AERIAL PHOTOGRAPHY SOURCED LANDGATE/ ESRI 2019
- OTHER DATA SOURCED LANDGATE 2019
(© Western Australian Land Information Authority 2018)

0 80 160 240
Meters
1:7,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

360 environmental
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PROJECT ID	DATE
3242	5/09/2019

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 49

CREATED	CHECKED	APPROVED	REVISION
SL	CM	SW	0

Horizon Power
Water Corporation Site

Detailed Flora and Fauna Survey

Figure 12
Fauna Habitat Assessment

K:\Projects\1.0 EBS\3242 Denham Flora & Fauna Survey\3242 Background Figures.mxd

5 Discussion

5.1 Flora and Vegetation

5.1.1 Flora

The suite of flora taxa recorded during the survey is considered typical for the respective areas (Beard 1976) and aligns with the database search results obtained. Despite the below-average rainfall recorded for the three months prior to commencing the survey, the floristic diversity was considered within the expected range for the bioregions for the timing of the survey undertaken. Despite a significant rainfall event occurred six weeks prior to the survey being undertaken where 60.4 mm was recorded over three consecutive days (7th to 9th June), the total rainfall for the three months and 12 months prior to the survey were 23.2 mm and 77.3 mm below the long term average for the same periods respectively. Due to the limited rainfall experienced in the area it is likely to have resulted in a lower species diversity and contributed to the considerable number of specimens that were unable to be identified due to the sterile nature of the specimens and is likely a major cause for recording lower herbaceous and annual species richness.

5.1.2 Flora of Conservation Significance

Conservation significant flora species identified in the desktop assessment with a medium and high likelihood of occurrence were targeted during the survey.

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded during the survey. One species was identified as Threatened in the desktop assessment, *Eucalyptus beardiana,* was considered to have a medium likelihood of occurrence within the Survey Area.

The review of the database searches identified 36 Priority flora species as potentially occurring in the vicinity of the Survey Area.

Three species were identified as recorded or potentially recorded within the Survey Area. These are as follows:

- *Acanthocarpus* affinis *rupestris* (P2) was identified from the specimen collected during the survey. This specimen is described to be related to but not identical to *Acanthocarpus rupestris* the Priority 2 species. This species was recorded in three of the four quadrats, and although is not identified as the Priority it is considered to be of the same level of significance. There are two records of *A. rupestris* identified 28.2 km from the Survey Area. Due to the presence of this species in three of the four quadrats it considered to be present throughout the Survey Area.
- *Olearia* ?occidentissima (P2) was recorded in all four quadrats, although specimens were not identified completely to species level due to absence of complete flowering parts. *O. occidentissima* is a prostrate shrub ranging up to 0.2 m high. Flowers are

white or pink, occurring July to September (Department of Biodiversity Conservation and Attractions, 2019b). There are two confirmed records of this species within 1 km of the Survey Area and are shown in Figure 7, one of the records is located within the boundary of the Survey Area. There are an additional seven records of the species identified between 1 and 33.3 km from the Survey Area. As there are several nearby records and an extensive area of suitable habitat, it is considered that *O. occidentissima* is present and in abundant across the site.

- *Triodia plurinervata* (P3) was recorded in abundance as the dominant species in the grassland strata of the AlTdTp vegetation type that is mapped to cover 11.78 ha of the Survey Area. *T. plurinervata* was recorded in all four quadrats surveyed. There are 21 records of *T. plurinervata* identified between 1.4 and 50 km of the Survey Area. This species was observed in abundance throughout the surrounds of the Survey Area.

Based on the habitat type present and known distribution, nine species have a high likelihood of occurrence within the Survey Area, these are as follows:

- *Abutilon* sp. Hamelin (A.M. Ashby 2196) (P1) is a shrub ranging from 0.08 to 0.5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are yellow/orange and brown and occur from July to September. The closest record is 1.4 km from the Survey Area and an additional seven records have been identified within 50 km. Due to the survey being undertaken within the flowering period of the species it is considered that if the species were present within the Survey Area it would have been identified. However, due to the suboptimal rainfall of the site within the 12 months prior to the survey, the presence of suitable habitat and several nearby records it is considered the species may still have the potential to occur within the Survey Area.
- *Chthonocephalus muellerianus* (P2) is an annual herb species ranging from 0.02 to 0.07 m high and flowers during September (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is 1.3 km from the Survey Area. No other records of the species have been identified within 50 km of the Survey Area. Due to the survey being undertaken outside the flowering period, the indistinct nature of the species and its existence as an annual species it is considered the species still has the potential to occur within the Survey Area.
- *Chthonocephalus tomentellus* (P2) is an herb species, flowering between August and November (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is 8.9 km from the Survey Area and there are an additional seven records identified between 11 and 33 km from the Survey Area. Due to the survey being undertaken outside the flowering period, the indistinct nature of the species and its existence as an annual species, it is considered the species still has a high likelihood of occurrence within the Survey Area.

- *Melaleuca oldfieldii* (P2) is a spreading shrub species, ranging between 0.3 and 1.5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are pink-purple or white and occur in August and October through December (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is approximately 2.3 km from the Survey Area, however this record is has not been verified (Department of Biodiversity Conservation and Attractions, 2019c). Although the survey was undertaken outside the flowering period of this species, due to its distinct nature of *Melaleuca* species and size, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.
- *Acanthocarpus parviflorus* (P3) is perennial herb ranging between 0.15 to 0.4 m high (Department of Biodiversity Conservation and Attractions, 2019b). The species flowers are white and occur from May to June. The closet record is 1.3 km from the Survey Area. One other record of the species was identified 37.7 km from the Survey Area. Due to the perennial nature, size of the species, and the survey occurring within the flowering period it is considered that if the species were present within the Survey Area it would have likely been identified during the survey. However, due to the suboptimal rainfall of the area within the 12 months prior to the survey and the presence of suitable habitat it is considered the species may still have the potential to occur within the Survey Area.
- *Anthocercis intricata* (P3) is a dense, spinescent shrub ranging between 0.9 and 3 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are white-cream and occur June to September (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is 1.4 km from the Survey Area and is the only record within 50 km. Due to the survey being undertaken within the flowering period and the distinct nature and size of the species it is considered that if the species were present within the Survey Area it would have likely been identified.
- *Bossiaea calcicola* (P3) is a spinescent shrub reaching up to 0.7 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are yellow-red and occur July to September (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is 1.3 km from the Survey Area. One other record was identified 39.0 km from the Survey Area. Due to the survey being undertaken within the flowering period and the distinct nature and size of the species it is considered that if the species were present within the Survey Area it would have likely been identified.
- *Grevillea rogersoniana* (P3) is a many-stemmed shrub ranging between 1.0 and 8.0 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are red, pink and/or purple and occur August to October (Department of Biodiversity Conservation and Attractions, 2019b). There are ten individual records of the species identified 1.3 km from the Survey Area. An additional four records

have been identified within 15 and 50 km from the Survey Area. Although the survey was undertaken outside the flowering period of this species, due to its distinct nature as a *Grevillea* and its size, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.

- ***Physopsis chrysophylla*** (P3) is an erect shrub ranging between 1 to 5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are yellow to orange in colour and occur September through January (Department of Biodiversity Conservation and Attractions, 2019b). The two known records are both located 1.3 km from the Survey Area. Although the survey was undertaken outside the flowering period of this species, due to its distinct nature and size, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.

Based on the habitat type present and known distribution, 12 species have a medium likelihood of occurrence within the Survey Area, these are as follows:

- ***Eucalyptus beardiana*** (T, VU): *Eucalyptus beardiana* is listed as Endangered under the BC Act 2016 and Vulnerable under the EPBC Act. *E. beardiana* is described as a Mallee tree with smooth bark, ranging between 3 and 5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are cream-white and occur between August to September. There are 71 records of the species with a distribution ranging approximately 300 km from the south of Shark Bay to the east of Geraldton (Department of Biodiversity Conservation and Attractions, 2019b, 2019c). The closest confirmed record to the Survey Area was identified approximately 67 km. Although the survey was undertaken outside the flowering period of this species, due to its distinct nature of Eucalypt species and it's the distinct size and form as a Mallee tree, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.
- ***Eremophila splendens*** (P1) exists as a shrub, flowering in September (Department of Biodiversity Conservation and Attractions, 2019b). The closest record is 42.7 km from the Survey Area. Although the survey was undertaken outside the flowering period of this species, due to its distinct nature of *Eremophila* species, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.
- ***Abutilon* sp. Quobba (H. Demarz 3858)** (P2) is an erect shrub ranging between 0.5 to 1.3 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are yellow-orange in colour and occur between July and September. The closet record is 14.9 km from the Survey Area. Due to the perennial nature, size of the species, and the survey occurring within the flowering period it is considered that if the species were present within the Survey Area it would have likely been identified during the survey.

- *Adenanthos acanthophyllus* (P2) is a robust shrub ranging from 2.0 to 6.0 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are red/pink and green and occur from April to July and can occur during December. The closet record is 44.5 km from the Survey Area. Due to the size of the species and the survey occurring within the flowering period it is considered that if the species were present within the Survey Area it would have likely been identified during the survey.
- *Ptilotus alexandri* (P2) is an erect, annual herb ranging from 0.1 to 0.3 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are pink and occur August to October. The closest record is located 28.2 km form the Survey Area. An additional three records have been identified within 38.0 and 44.3 km from the Survey Area. Due to the survey being undertaken outside the flowering period, the indistinct nature of the species and its existence as an annual species it is considered the species still has the potential to occur within the Survey Area.
- *Scaevola chrysopogon* (P2) is a perennial herb or shrub, ranging from 0.3 to 0.6 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are white-cream and occur August to October. Three records are located between 44.5 and 46.2 km from the Survey Area. Due to the survey being undertaken outside the flowering period and the existence through various forms species it is considered the species may have the potential to occur within the Survey Area.
- *Thryptomene repens* (P2) is a spreading shrub, and has been recorded ranging between 0.1 to 2 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are pink and have been observed between November and January. The closest record is 39.0 km from the Survey Area. As the survey was undertaken outside the suspected flowering range and due to the limited reference material available for this species it is considered to still have the potential to occur within the Survey Area.
- *Lepidium biplicatum* (P3) is an erect shrub with small white flowers that occur in September (Department of Biodiversity Conservation and Attractions, 2019b). There are six records within 45 km for the Survey Area. Due to the survey being undertaken outside the flowering period it is considered the species may have the potential to occur within the Survey Area.
- *Macarthuria intricata* (P3) is an intricately branched shrub ranging from 0.4 to 1.0 m high and 3 m wide (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are white-cream-yellow and occur September to December. The closest record is 44.5 km from the Survey Area. Although the survey was undertaken outside the flowering period, due to the distinct size and perennial nature of the shrub if the species were present within the Survey Area it would have likely been identified during the survey.

- *Melaleuca huegelii* subsp. *pristicensis* (P3) is a shrub or tree ranging from 0.9 to 5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are pink-purple and occur September to October. Six records have been identified between 26.8 and 44.7 km form the Survey Area. Although the survey was undertaken outside the flowering period of this species, due to its distinct nature of *Melaleuca* species and its size, it is considered that if the species were to exist within the Survey Area it would have likely been identified during the survey.
- *Phyllanthus fuernrohrii* (P3) is a perennial herb or shrub ranging from 0.6 to 1 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers have been observed as green in colour, however the flowering period has not yet been determined. The closest record is 39.8 km from the Survey Area. Due to the limited information available for this species it is considered to still have the potential to occur within the Survey Area.
- *Triodia bromoides* (P4) is a tussock-forming perennial grass that ranges 0.5 to 1.5 m high (Department of Biodiversity Conservation and Attractions, 2019b). Flowers are green-purple and occur from July to October. There are 14 records identified within 36 to 45 km from the Survey Area. Due to the perennial nature, size of the species, and the survey occurring within the flowering period it is considered that if the species were present within the Survey Area it would have likely been identified during the survey.

Of the remaining potential Priority species, 13 are considered to have a low likelihood of occurrence within the Survey Area.

The presence of a Priority taxa does not form a statutory constraint for the Survey Area. There is no written policy on how to respond to the presence of Priority flora species within proposed development sites. The presence of the species is dealt with by DWER and DBCA on a case-by-case basis.

5.1.3 Introduced Flora

One is listed as a Weed of National Significance. **Lycium ferocissimum* was recorded across the Survey Area in all four quadrats and the one releve. This species is problematic in Australia due to its invasiveness, potential for spread, and economic and environmental impacts. It is a dense woody shrub up to 4 m high and 3 m wide and found across southern Australia in agricultural and pastoral areas and waste places around towns and cities (Haegi, 1976). It seems tolerant of most soil types and of some salinity. It is especially abundant in areas of high rainfall. Where its distribution enters drier regions, the plants are generally found close to permanent or seasonal water supplies (Haegi 1976). Some mechanical control of African Boxthorn is possible but there is likely to be re-growth from soil seed stores or from the taproot, meaning that cultivation and/or herbicides may need to be the next step (Haegi, 1976).

5.1.4 Vegetation Types

To demonstrate enough survey effort, the statistical analysis and species accumulation curve were undertaken. However, due to the small sample size of quadrats and releve5) and the relatively small Survey Area (13.5 ha) the results of statistical analysis were deemed inconclusive and were not relied upon for delineating vegetation types. Due to the consistency in dominant species observed across all strata levels for each of the quadrats and releve within the of the Survey Area, one vegetation type was delineated to occur across most of the Survey Area within the large intact section located on Lot 345. Four quadrats and one releve were established across the section meeting the minimum requirement of three quadrats per vegetation as per the EPA Technical Guidance. The remaining section, running east west along an existing track, and then to the parallel to Monkey Mia Road, of the Survey Area was, was mapped by extrapolating data collected in mapping notes. Quadrats were unable to be established due to the 15 m width of this section. This section is mapped across three vegetation types. This could be possibly explained due to several reasons:

- Immediacy to road: Due to the proximity to the road, the area is subject to additional disturbances such as dust, decreased wind protection, foot traffic and litter that may influence the establishment of flora species and therefore influence vegetation mapping
- Geological composition: The vegetation observed exhibits a loss in the presence of *Triodia* hummock grasslands when transitioning southwards within the Survey Area. This is to be expected when considering the Survey Area is located just south of the border of two land and soil systems (Figure 3). The Taillefer System to the Peron System, the characteristic change is described as the loss in spinifex grasslands which is observed when transitioning south. This is further supported when assessing the broad vegetation mapping (Figure 4) which transitions from the Peron 112 vegetation type to Denham 1101, where the main characteristic change again is described as the loss of hummock grasslands.

The Survey Area is representative of a transitional area consistent with existing broad scale vegetation and soil and land system mapping, and consistent with the vegetation composition observed during the survey.

To further delineate vegetation types across the Survey Area additional statistical analysis was undertaken with additional quadrat data from nearby surrounding areas (360 Environmental Pty Ltd, 2019a, 2019b). Although, still inconclusive due to relatively small areas and sample size similarities (28% and 32 %) were noted across the three of the four quadrats within the Survey Area (Appendix E).

5.1.5 Vegetation of Conservation Significance

One Priority Ecological Community listed by the State and identified within 20 km radius of the Survey Area. None of the vegetation types identified across the Survey Area are

representative of the PECs identified in the desktop assessment due to the absence of suitable habitat required to support the PEC.

5.2 Vertebrate Fauna

Marine Birds

Of the 37 conservation significant fauna species (including Priority species), 28 of these are marine/coastal birds or wetland dependent migratory birds (76%). Although all of these marine/coastal bird species have the potential of occurring within the Survey Area (due to the proximity to the coast), none are likely to utilise these fauna habitats for either foraging, refuge or breeding. All have therefore been excluded from any further discussion and are considered unlikely to be negatively impacted by any disturbance within the Survey Area.

Any species with a conservation listing which is solely Marine under the EPBC Act, including the White-bellied Sea-Eagle, Black-faced Cuckoo-shrike, Tree Martin and Silver Gull are generally common and are not of conservation significance. As the Survey Area contains no marine specific habitat and these species are not considered conservation significant, these species have also been excluded from any further discussion.

5.2.1 Fauna Habitat

All fauna habitats identified in the Survey Area during the field survey are considered to be common throughout the surrounding remnant vegetation areas (bushland surrounding the Survey Area) and also common throughout the overall Carnarvon bioregion and the Wooramel (CAR2) subregion. This includes the *Acacia* shrublands (Mulga, Bowgada and *A. coriacea*) over bunch grasses on red sandy ridges and plains (Desmond and Chant, 2001).

The two broad vegetation types that comprise the Survey Area continue extensively throughout the surrounding region, with Denham 1101 continuing to the north (with a total 16,260 ha) and Perron 112 continuing to the south (with a total 25,150 ha).

The fauna habitats that occur within the Survey Area provide value to common fauna species of the region, providing important refuge, foraging and breeding habitat. However, none provide specialist habitat value to any conservation significant fauna species.

5.2.2 Species Recorded within the Survey Area

No species of conservation significance were Recorded during the survey.

5.2.3 Species Considered to have a High Likelihood of Occurrence

A total of two species of conservation significance are considered to have a high likelihood of occurrence within the Survey Area, including the Osprey and Western Grasswren. Each are discussed below.

Osprey (*Pandion haliaetus*) – Migratory & Marine

The Eastern Osprey is considered to be moderately common in Australia (Olsen, 1998). The species is most abundant in northern Australia, where high population densities occur in remote areas (Johnstone and Storr, 1998). They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia (Marchant and Higgins, 1993; Olsen, 1995; Johnstone and Storr, 1998). They require extensive areas of open fresh, brackish or saline water for foraging (Marchant and Higgins, 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes (Olsen, 1995; Johnstone and Storr, 1998).

Although the species is considered to have a high likelihood of occurrence within the Survey Area, it will not regularly utilise the Survey Area and is not dependent on any of the fauna habitat, due to the lack of wetland habitats. Any disturbance within the Survey Area is unlikely to impact the species.

Western Grasswren (*Amytornis textilis textilis*) – Priority 4

The Western Grasswren has disappeared from most of its southern arid zone but is still moderately common in Shark Bay. In the Shark Bay region, the species prefers *Acacia* shrubland with dense shrub clumps and lower recumbent shrubs in which foliage extends to the ground (Menkhorst *et al.*, 2017). The species occurs in four types of shrubland (Higgins, Peter and Steele, 2001), two of which are similar to that fond within the Survey Area:

- *Acacia* shrublands on coastal dunes, coastal plains and red sandplains, dominated by Umbrella Bush *Acacia ligulata*, Dead Finish *Acacia tetragonophylla*, Horse Mulga *Acacia ramulosa* and *Acacia sclerosperma*, with chenopods such as saltbush *Rhagodia* spp. and Coastal Bonefruit *Threlkeldia diffusa*, other species of shrubs 1-3 m tall with a recumbent growth form that support twining species, and an extensive ground-cover of low shrubs, grasses and herbs.
- Low (less than 1.5 m high) shrublands on calcareous sandplains, dominated by Umbrella Bush, Native Cherry *Exocarpus* spp., and other shrubs such as *Thryptomene* spp., and *Ptilotus* spp., mixed with hummocks of spinifex *Triodia* spp., and sometimes with saltbush *Atriplex* spp.

The species has been recorded in close proximity to the Survey Area with four records recorded within 2 km of the Survey Area and a total of 21 records within 20 km of the Survey Area in the last 15 years. The species occurs throughout most of the Peron Peninsula. Although not recorded during the survey, the Western Grasswren is an inconspicuous species (Menkhorst *et al.*, 2017), potentially occurring within the Survey Area but not being detected during the field survey.

The Survey Area contains habitat that is preferred by the species in the *Acacia* Shrubland. Although the species has a high likelihood of occurrence within the Survey Area and is

likely to utilise the fauna habitat for both breeding, foraging and refuge, the Survey Area does not provide any specific value to the species that differs to the surrounding habitat. The species will also utilise the surrounding fauna habitat and therefore any disturbance within the Survey Area is unlikely to impact the species.

5.2.4 Species Considered to have a Medium Likelihood of Occurrence

Eight conservation significant fauna species are considered to have a medium likelihood of occurrence within the Survey Area. This includes four marine/coastal birds, as well as the following four terrestrial species:

- Pacific Swift (*Apus pacificus*) – Migratory & Marine
- Malleefowl (*Leipoa ocellata*) – Vulnerable
- Bilby (*Macrotis lagotis*) – Vulnerable
- Woma (*Aspidites ramsayi*) – Priority 1 (South West Population).

Each of the four species listed above are discussed below.

Pacific Swift (*Apus Pacificus*) – Migratory and Marine under the EPBC Act

The Pacific Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The Pacific Swift occupies a large airspace range (i.e. low to very high) over varied habitats, ranging from rainforests to semi-deserts (Morcombe, 2003). Although the species has the potential to occur in the airspace above the Survey Area, it will not be reliant on the habitats of the Survey Area. In addition, it has not been recorded within 10 km of the Survey Area in the last 15 years.

It is therefore concluded that the species will not be depend on the terrestrial habitat identified within the Survey Area and disturbance within the Survey Area is unlikely to impact the species.

Malleefowl (*Leipoa ocellata*) – Vulnerable (BC Act and EPBC Act)

The Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or *Acacias*. A sandy substrate and abundance of leaf litter are required for breeding. Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils where habitats tend to be thicker and there is an abundance of food plants. Much of the best habitat for Malleefowl has already been cleared or has been modified by grazing via Sheep, Cattle, Rabbits and Goats (Benshemesh, 2007).

Project Eden was an ambitious large-scale conservation project with the primary goal of translocation and reconstruction of the pre-European fauna populations of the Peron Peninsula, within the Shark Bay World Heritage Property (Morris *et al.*, 2004). The project was an initiative of the then Department of Conservation and Land Management (CALM), now DBCA. Six species once found on the peninsula were reintroduced into Francois Peron

National Park, although the only two that established viable populations were the Malleefowl and Bilby. While still quite rare, these species have been breeding on the peninsula for several years and are occasionally seen on roads and tracks in and near the park. Malleefowl was recorded during the Ninox Wildlife Consulting survey for the Coburn Mineral Sand Mine, undertaken in 2002 (Ninox Wildlife Consulting, 2005) and by 360 Environmental on Useless Loop Road in 2018 (360 Environmental Pty Ltd, 2018).

Project Eden collected Mallefowl eggs from the wild in Kalbarri National Park, Nanga Station and northern wheat-belt reserves. The eggs were artificially incubated and the chicks hand-reared in the Peron Captive Breeding Centre before release. More than 65 Malleefowl were raised and released at 14 sites in Francois Peron National Park between September 1997 and September 1998 (Morris *et al.*, 2004). Some released animals were fitted with radio transmitters to monitor their dispersal and survival rates. Malleefowl are still being sighted in 2016.

The Survey Area occurs within the known distribution of the species, and the Survey Area contains appropriate habitat in the form of *Acacia* Woodland. In addition, nine DBCA records of the species have been recorded within the Study Area in the last 15 years. Consequently, there is a possibility the species may occur within the Survey Area. However, the preferential habitat of the species comprised of Mallee woodland (due to the high leaf litter loads), are not present within the Survey Area. Also, targeted transect searches for the species did not yield any evidence of the species currently utilising the Survey Area.

Therefore, as it would appear the species is not currently utilising the Survey Area, and it does not contain the species preferred habitat, disturbance within the Survey Area is unlikely to impact the species.

Bilby (*Macrotis lagotis*) – Vulnerable

The Bilby was common throughout most of its range until the early 1900s when there was a sudden and widespread collapse. Its distribution may still be contracting and fragmenting. Direct and indirect impacts on food by a changing fire regime and the grazing of rabbits and livestock, predation by foxes and feral cats and drought in varying combinations are probably responsible for the decline (Woinarski, Burbidge and Harrison, 2014).

Bilbies occupy a variety of habitats that includes Mitchell Grass and stony downs country of cracking clays, the desert sandplains and dune fields sometimes containing laterite, with hummock grassland (Spinifex) and massive red earths with Acacia shrubland (Southgate, R, Paltridge, R, Masters, R, & Carthew, 2007; Van Dyck and Strahan, 2008). Free surface water is not typically available in the Bilbies range; as a result they derive most of their water from food. They are omnivorous and have a diet that consists of insects and their larvae, seeds, fruit and fungi and the proportions of these components in the diet can vary depending on location (Southgate and Carthew, 2006).

The same as the Malleefowl mentioned above, the Bilby has also been re-introduced to Peron Peninsula (within Francois Peron National Park) as part of Project Eden. A total of 151 bilbies from the Peron Captive Breeding Centre and 20 from Dryandra were released at ten sites on Peron Peninsula between October 2000 and 2005 (Morris *et al.*, 2004). Bilbies were still doing well when about 30 more were released on the peninsula in 2013. Bilbies are apparently still being sighted in 2016.

Although the Survey Area contains the preferred fauna habitat of the species, the fauna habitat is similar throughout most of the Peron Peninsula. The Survey Area does not contain any specialist fauna habitat compared to the surrounding areas. Bilby activity is generally obvious in nature, due to the obvious diggings, scats and tracks left in the soft sand. Intensive targeted searches throughout the entire Survey Area did not identify any evidence of the species.

Therefore, as it would appear the species is not currently utilising the Survey Area, and similar habitat surrounds the Survey Area, any disturbance occurring within the Survey Area is unlikely to impact the species.

Woma (Aspidites ramsayi) – Priority 1 (South West Population)

The Woma is a desert species that is most often associated with sandy terrain but is sometimes found in stony environments adjacent to sandy country. The range in Southwest Australia extends from Shark Bay, along the coast and inland regions, and was previously common on sandplains. The species was recorded in regions to the south and east, with once extensive wheatbelt and goldfield populations (Browne-Cooper R, Bush B, Maryan B, 2007).

The Survey Area occurs at the northern most extent of the species distribution. Although the Survey Area contains suitable habitat for the species, it does not contain any specialist fauna habitat for the species compared to the surrounding areas that occur on the Peron Peninsula. In addition, only one record of the species has been recorded within the Study Area in the last 15 years, suggesting it is not common to the area. Therefore, although it is considered that the species has a medium likelihood of occurrence, similar habitat surrounds the Survey Area and the species appears to occur in relatively low abundance. Consequently, any disturbance occurring within the Survey Area is unlikely to impact the species.

6 Conclusion

Flora and Vegetation

In summary, the following conclusions on the existing flora and vegetation are made:

- No Threatened flora species pursuant to the *EPBC Act* 1999 and/or gazetted as Threatened/Declared Rare Flora pursuant to the *BC Act* 2016 were recorded during the survey
- Three DBCA listed Priority flora are considered to have been recorded; *Acanthocarpus* affinis *rupestris* (P2), *Olearia occidentissima* (P2) and *Triodia plurinervata* (P3). The presence of these species is unlikely to form a statutory constraint for the Survey Area and is dealt with by DWER and DBCA on a case by case basis
- Five introduced species were recorded during the survey. One species, **Lycium ferocissimum* is listed as a Weed of National Significance by the Department of Energy and Environment (2018)
- Three vegetation types were mapped within the Survey Area. Towards the south-west portion of the Survey Area, a significant change is observed due to the loss of *Triodia plurinervata* dominant grasslands. This change is expected and consistent with broad scale soil and vegetation mapping.

Vertebrate Fauna

- No vertebrate fauna species of conservation significance were recorded during the level 1 vertebrate fauna survey, including targeted searches for evidence of Bilby and Malleefowl
- Two species of conservation significance are considered to have a high likelihood of occurrence within the Survey Area (Osprey and Western Grasswren) and eight species of conservation significance are considered to have a medium likelihood of occurrence within the Survey Area (includes four marine/coastal species as well as the Pacific Swift, Malleefowl, Bilby and Woma)
- The Survey Area does not contain any specialist fauna habitat for any of the above conservation significant species, and the fauna habitat is common, extending to the north and south of the Survey area, and likely throughout the Peron Peninsula
- Therefore, disturbance within the Survey Area is unlikely to impact any of the identified conservation significant vertebrate fauna species.

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8 Limitations of this Report

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

APPENDIX A

Database Searches

Pop ID	Name ID	Taxon	Cons Status	Pop #	Sub Pop	Location	District	Vesting	Purpose 1	Count Date	In Flower
84588	1210	*Acanthocarpus rupestris*	2	5		1.8 km approximately south of Useless Loop township and 2.1 km south of Trig Station, Shark Bay. On east side of Useless Loop-Perth Road.	SHARK BAY	NON	UCL	08-10-97	N
94358	18132	*Dicrastylis sp. Denham (M. Lewis 42/92)*	1	1		Shark Bay Road reserve, 17 km south of Denham on right side of road.	SHARK BAY	MRD	VER	26-09-92	N
93855	17151	*Eremophila splendens*	1	2		UCL, Ex- Carrarang leasehold, Steep Point area, ca 2.5 km SE of Mount Direction, Shark Bay.	SHARK BAY	EXD	EPL	21-09-97	N
93856	17151	*Eremophila splendens*	1	3		UCL, Ex- Carrarang leasehold, Steep Point area, ca 5 km SE of Monkey Rock, Shark Bay.	SHARK BAY	EXD	EPL	22-09-97	N
93857	17151	*Eremophila splendens*	1	4		UCL, Ex- Carrarang leasehold, 7 km SE from Steep Point, at Blackies Beach, [ca 400 m WNW of Ranger Station], Shark Bay.	SHARK BAY	EXD	EPL	31-08-05	Y
94248	17885	*Triodia bromoides*	4	1		Towards S end of Useless Inlet, on W side. ca 1km S of levee banks for salt evaporators. Carrarang Station.	SHARK BAY	NON	PAS	04-10-89	N
94251	17885	*Triodia bromoides*	4	2		Towards S end of Useless Inlet, on E side. ca 3.5m NE of E side of levee bank for salt evaporators. Carrarang Station.	SHARK BAY	NON	PAS	31-10-89	N
94253	17885	*Triodia bromoides*	4	4		ca 6km SE of Steep Point. Carrarang Station.	SHARK BAY	NON	PAS	06-10-89	N
103847	17885	*Triodia bromoides*	4	5	A	Dirk Hartog Island. 0.8km W of homestead. Pastoral lease 3114/470.	SHARK BAY	NON	PAS	03-09-72	N
103848	17885	*Triodia bromoides*	4	5	B	Dirk Hartog Island. Near homestead. Loc 62.	SHARK BAY	NON	PAS	17-10-74	N

Sheet	Name ID	Taxon	Cons Code	Plant Description	Site	Vegetation	Frequency	Notes	Locality	Geo Method	Precision	Date
7457758	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2	Shrub 1.5 m high with yellow flowers.	Plain flat, Dirk Hartog Island. Red sand.	Low shrubland with associated vegetation: Acacia sp., Diplolaena grandiflora, Exocarpus sp.	2 - 5 plants.	Percentage of population flowering 20 %	Eastern track, southern end	GPS	1	30/08/2006
5188156	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2						Dirk Hartog Island	MAN	4	/09/1980
4304845	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2	2-4 ft high.	Brown sandy clay.			Abundance: occasional	32 km S turn right 3rd grid to break in fence,	AUTO	4	11/07/1992
5262836	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2		On cream silt on very gently inclined midslope of undulating uplands, above birrida.	Acacia sp Low Scrub A over Pimelea microcephala-A. tetragonophylla -Stylobasium spathulatum Low Scrub B over Pittosporum phylliraeoides-Scaevola spp Low Heath C over Enchylaena tomentosa-Maireana tomentosa Low Heath D.			Approximately 8.5 km S of Useless Loop Township and Trig Station, Shark Bay. N of gypsum minesite on E side of road. [Plot-uslp06.]	MAN	0	8/10/1997
5241685	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2		On pale red silty sand with 40% surface cover of litter on upland.	Pimelea microcephala-Acacia tetragonophylla-Alectryon oleifolia-Santalum acuminatum Heath B over Thryptomene sp.-Melaleuca cardiophylla-Threlkeldia diffusa-Enchylaena tomentosa Low Heath D over Austrostipa spp. Grass over Herbs.			Approximately 2.5 km SW of Trig Station Spit, Heirisson Prong, Shark Bay. East of Rubberneck Rd. [Plot-hepr02.]	MAN	0	26/09/1997
5263093	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2		On shallow red silty clay with 75% surface cover of limestone pavement and 20 % surface cover of litter on NE facing, gently sloping upland.	Diplolaena grandiflora-Ptilotus obovatus-Atriplex paludosa-Dodonea inequifolia-Acacia tetragonophylla Low Heath C to Dwarf Scrub D over Crassula colorata-Dioscorea hastifolia Herbs and Austrostipa spp Grass.			c.10km N of Bibby Giddy Outcamp on Heirisson Prong. 30m SSE of Clough's Bar track at c.2.4km along track from jnc with Useless Loop Rd. [Plot-clbr02.]	MAN	0	25/09/1997
3328112	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2	Slender shrub to 50 cm, flowers yellow with brown centres, brownish outside.	In sand.	On Acacia steppe.			c. 0.8 km W of homestead, Dirk Hartog Island	MAN	0	3/09/1972
7111584	14112	*Abutilon sp. Homelin (A.M. Ashby 2196)*	2	Upright herb, 0.3 m high x 0.1 m wide. Dark yellow large flower with the centre 1/2 deep maroon colour.	Undulating. Red sand.	Hummock grassland with Buffel, Spinifex, Commersonia sp.	rare.		Shearing Shed 5 Track-Zone 4	GPS	0	19/07/2004
7988850	14114	*Abutilon sp. Quobba (H. Demarz 3858)*	2	Erect compact perennial shrub, height to 1.7 m, width to 90 cm.	Valley to plain; bare to littered brown clayey sand.	Scrub.	abundant.	Also present: smut.	Fire plots on 18 mile track, Peron Peninsula	AUTO	2	15/10/2008
5264529	3309	*Acacia drepanophylla*	3		On red sand with limestone pavement and 30% surface cover of litter, on upland with ENE aspect.	Acacia spp-Santalum spicatum Open Scrub over Dodonea inaequifolia-Exocarpos aphyllus -Acacia tetragonophylla Heath B over Rhagodia latifolia-Ptilotus spp Dwarf Scrub over Enchylaena tomentosa-Maireana tomentosa Low Heath D.			Approximately 3 km west of Monkey Mia Jetty, Peron Peninsula, Shark Bay. West of track to water front north from Monkey Mia RD. [Plot-mmia01.]	MAN	0	14/10/1997
1218530	3309	*Acacia drepanophylla*	3					Peron 104.	Peron Peninsula, Shark Bay	MAN	4	16/11/1989
614254	3309	*Acacia drepanophylla*	3						Nanga Bay - Shark Bay area	AUTO	3	//1976
5480078	3309	*Acacia drepanophylla*	3	Bushy small tree ca 3 m tall. Spikes pale yellow.	On sandy rise adjacent to dry salt lake.	With much Acacia sclerosperma.	scattered and localised.		Ca 5 km SW of Monkey Mia on road to Denham,	AUTO	3	13/01/2000
1231103	1207	*Acanthocarpus parviflorus*	3						Shark Bay.	AUTO	5	//1989
1231081	1207	*Acanthocarpus parviflorus*	3		Low limestone rise between two birridas; limestone at surface, with orange-brown siliceous sand.	Heathland dominated by Melaleuca eleuterostachya, Bowgardia.		Site 102.	Shark Bay.	MAN	3	1/10/1989
5263719	1210	*Acanthocarpus rupestris*	2		On cream sandy silt with greater than 5% surface cover of litter, on gently inclined, W-facing footslope at the back of dune.	Acacia tetragonophylla open Dwarf Scrub C over Melaleuca cardiophylla -Thryptomene sp Low Heath D over Triodia pleurinervata Dense Hummock Grass over Podolepis canescens-Lobelia heterophylla Very Open Herbs.			1.8 km approximately S of Useless Loop Township and Trig Station, Shark Bay, on E side of Useless Loop-Perth Rd. [Plot-uslp05.]	MAN	0	8/10/1997
1080296	1768	*Adenanthos acanthophyllus*	2						Nanga Station, on road to Tamala Station, S of Shark Bay	MAN	3	26/08/1969
7457723	7830	*Angianthus microcephalus*	2	Herb 0.1 m high x 0.1 m wide. Flowers yellow.	Dirk hartog Island. White dry clay loam. Associated with depressions in saltflat.	Halosarcia sp., saltflats.	6 - 20 plants.	Percentage of population flowering 80 %	Airstrip southern side	GPS	1	30/08/2006
414093	7830	*Angianthus microcephalus*	2		On salt flat.				By airfield, W of homestead, Dirk Hartog Island	MAN	3	3/09/1972
6000886	7830	*Angianthus microcephalus*	2	Prostrate decumbent annual; yellow flowers, in early flower.	Red sand flat by saline channel; red clay sand.	Atriplex vesicaria low open shrubland.	very common.		Faure Island, Shark Bay,	MAN	2	28/05/2000
1243268	6948	*Anthocercis intricata*	3						Denham (Shark Bay)	AUTO	3	/06/1957
5678641	19520	*Baronia crenulata subsp. Shark Bay (G. Cockerton 5187)*	1	Shrub to 0.6 m high. Flowers pink.	On limestone outcrop.				Useless Loop Road, Shark Bay,	MAN	4	25/08/2000
1400045	30232	*Bossiaea calcicola*	3	Buisson epineux, haut de 60 cm, fleurs orange et rouge.					Shark Bay, False entrance	AUTO	4	24/07/1988
2722887	30232	*Bossiaea calcicola*	3	Spreading shrub 30 m; flowers yellow and red.	In sand.	On steppe.			N side of Passage Paddock, Dirk Hartog Island	MAN	0	2/09/1972
5241278	48659	*Calandrinia sp. Edel Land (F. Obbens FO 01/17)*	2		On shallow red silty clay with 75% surface cover of limestone pavement and 20 % surface cover of litter on NE facing, gently sloping upland.	Diplolaena grandiflora-Ptilotus obovatus-Atriplex paludosa-Dodonaea inequifolia -Acacia tetragonophylla Low Heath C to Dwarf Scrub D over Crassula colorata-Dioscorea hastifolia Herbs and Austrostipa spp. Grass.			c.10km N of Bibby Giddy Outcamp on Heirisson Prong. 30m SSE of Clough's Bar track at c.2.4km along track from jnc with Useless Loop Rd. [Plot-clbr02.]	MAN	0	25/09/1997
5248493	18359	*Carpobrotus sp. Thevenard Island (M. White 050)*	3		On deep, white sand with 60% surface cover of litter, on steep upper duneslope.	Acacia ligulata/rostellifera-Alyogyne cuneiformis Low Scrub A over Beaufortia dampieri -Melaleuca cardiophylla-Pimelea microcephala-Thryptomene sp-Rhagodia spp Low Heath C over Threlkeldia diffusa Dwarf Scrub C over Grass over Her			Steep Point, Shark Bay. Approximately 7.5 km SE of Mt Direction. South of Steep Point Track and old fenceline. [Plot-stpt12.]	MAN	0	24/09/1997
7832168	18359	*Carpobrotus sp. Thevenard Island (M. White 050)*	3	Perennial prostrate succulent plant with height 10 cm and width 2 m.	Grey dry sand, dune, reserve.	Low shubland and grassland with low mat of Carpobrotus and Sporobelus virginicus.	over 50 plants.		Bottle Bay Camp, behind toilets, Francois Peron National Park Denham area	UNK	2	12/05/2007
991597	12616	*Chthonocephalus muellerianus*	2						Near Shark Bay	AUTO	5	17/09/1941
4304764	7934	*Chthonocephalus tomentellus*	2	Prostrate.	Red clayey sand.	Shrubland.		Abundance: frequent	Monkey Mia bore and follow track to Cape Rose Beach,	AUTO	4	29/08/1992
1233297	7934	*Chthonocephalus tomentellus*	2		Upper slope, east facing in gently undulating area; orange-brown siliceous sand with paler surface.	With Lamarchea, Scaevola spinescens, Ptilotus obovatus.		Peron site 61.	Peron Peninsula, Shark Bay.	AUTO	3	9/11/1989
5269873	7934	*Chthonocephalus tomentellus*	2		On red sand with 40% surface cover of litter on upland.	Lamarchea hakeifolia var hakeifolia-Olearia dampieri ssp dampieri-Rhagodia preissii ssp obovata-Rhagodia latifolia ssp latifolia-Ptilotus obovatus var obovatus-Acanthocarpus robustus Dense Low Heath C.			Approximately 5 km NNW of Peron Homestead, Peron Peninsula, Shark Bay.	MAN	0	11/10/1997
5021030	7934	*Chthonocephalus tomentellus*	2	Annual prostrate herb.	Gentle NW facing slope on undulating sandplain. Red/orange sand.	Acacia spp. Open Scrub over Exocarpos sp., Acacia tetragonophylla, Rhagodia sp. Open Dwarf Scrub C over Ptilotus obovatus Open Dwarf Scrub D over Very Open Herbs			N side of Monkey Mia Road 12.75 km W of Monkey Mia Caravan Park entrance on road to Denham. (Site: 72).	GPS	1	30/08/1992
5021065	7934	*Chthonocephalus tomentellus*	2	Annual prostrate herb.	Gentle WNW facing slope on undulating sandplain. Red/orange sand.	Acacia ramulosa, Acacia tetragonophylla and Acacia sp. Open Low Scrub A over Dodonaea sp. and Rhagodia sp. Open Dwarf Scrub C over Brassica sp. Very Open Herbs			N side of Monkey Mia Road 4.5 km W of Monkey Mia Caravan Park entrance on road to Denham. (Site: 71).	GPS	1	30/08/1992
5020999	7934	*Chthonocephalus tomentellus*	2	Annual prostrate herb.	Flat on undulating sandplain. Red/orange sand.	Acacia linophylla and Lamarchea sp. Open Scrub over Scaevola sp. and Rhagodia sp. Open Low Scrub A over Ptilotus obovatus Open Dwarf Scrub D over Aristida contorta Open Grass over Open Herbs			Francois Peron National Park, N of fence on track that goes E (3.6 km) from Cape Peron Road at 11 km N of Peron Homestead. (Site: 73).	GPS	1	31/08/1992
5664616	7934	*Chthonocephalus tomentellus*	2	Prostrate annual herb, flowers yellow, in full flower.	Low dune. Red sand.	Acacia low open shrubland.	common in area.		3 km W of Monkey Mia,	AUTO	3	29/08/1989
6097200	7934	*Chthonocephalus tomentellus*	2	Annual. Flowers yellow.	Red sand flat by saline channel. Red sand - clay.	Atriplex vesicaria low shrubland with scattered Acacia tetragonophylla.	rare.		Northern end Faure Island, Shark Bay	GPS	1	28/05/2000
4134370	18132	*Dicrastylis sp. Denham (M. Lewis 42/92)*	1	Dwarf shrub.	Grey sand.	Hummock grassland.	occasional.		17 km S Denham, right side of road	MAN	3	26/09/1992
4567501	14196	*Eremophila cuneata*	1					Voucher collections from two plants (A & B) for propagation. Cuttings and grafted material unsuccessful (4/12/1995).	c. 5-6 km SE of Steep Point, Carnarvon Botanical District,	MAN	2	25/10/1995
8260362	17151	*Eremophila splendens*	1	Shrub to 50 cm, sparse, woody flowers red.	Uneven, sand.	Heathland. Associated taxa: Brachyscome latisquamea, Senecio spp., Podolepis spp.			Steep Point, 6.1 km S Blackies camp	UNK	1	31/08/2005
8260354	17151	*Eremophila splendens*	1	Shrub to 50 cm, sparse, woody flowers orange.	Uneven, sand.	Heathland. Associated taxa: Brachyscome latisquamea, Senecio spp., Podolepis spp.			Steep Point, 6.1 km S Blackies camp	UNK	1	31/08/2005
5251087	17151	*Eremophila splendens*	1		On deep, cream sand with 30% surface cover of litter, on dune crest.	Alyogyne cuneiformis Open Low Scrub A over Melaleuca cardiophylla-M. huegelii -Diplolaena grandiflora Low Scrub B over Dense Low Heath C over Threlkeldia diffusa-Rhagodia preissii-R. latifolia-Thryptomene sp Low Heath D.			Steep Point, Shark Bay. Approximately 2.5 km SE of Mt Direction. [Plot-stpt04.]	MAN	0	21/09/1997

Sheet	Name ID	Taxon	Cons Code	Plant Description	Site	Vegetation	Frequency	Notes	Locality	Geo Method	Precision	Date
7385803	17151	*Eremophila splendens*	1	Shrub to 30 cm, red flowers.	Steep.	Heath. Brachyscome latisquamea, Myoporum parvifolium.			7 km from Steep Point at Blackies Beach	GPS	1	31/08/2005
5248140	17151	*Eremophila splendens*	1		On deep, cream sand to silty sand on lowland plain.	Melaleuca cardiophylla-Thryptomene sp Low Heath D over Triodia bromoides Mid-Dense Hummock Grass over Waitzia podolepis-Senecio lautus Open Herbs.			Steep Point, Shark Bay. Approximately 5 km SE of Monkey Rock. [Plot-stpt08.]	MAN	0	22/09/1997
5247284	13544	*Eucalyptus zopherophloia*	4	Mallee form.	On deep, red sand with 40% surface cover of litter, on SW-facing gentle slope on upland.	Eucalyptus aff prominens Low Forest A over Acacia ligulata/rostellifera -Exocarpos aphyllus Heath A over Pimelea microcephala-Scaevola spp Low Scrub B over Ptilotus obovatus-P. divaricatus-Thryptomene sp Low Heath D			Approximately 8.5 km N of Peron Homestead, Peron Peninsula, Shark Bay. East of Peron Homestead-Cape Peron Rd. [Plot-pern09.]	MAN	0	13/10/1997
2118866	2083	*Grevillea rogersoniana*	3						Shark Bay road	AUTO	5	/01/1962
1841122	2083	*Grevillea rogersoniana*	3					Collection date: Jan/Feb 1962 ?	Between Shark Bay and Hamelin Pool Station	AUTO	5	/01/1962
2850788	2083	*Grevillea rogersoniana*	3		Red sand over red sandy clayloams.				"Nilemah", a bore on the SE side of Nanga Station, near the S end of Hamelin Pool	AUTO	4	/10/1992
1336274	2083	*Grevillea rogersoniana*	3	Shrub to 4 m, flowers deep pink-red.	Red sand.	Acacia scrub.		Poison - Mercuric chloride may be present on specimen.	36 miles S of Denham	AUTO	3	26/08/1969
1223232	2083	*Grevillea rogersoniana*	3		Slight slope from fairly high crest, orange brown sand with pale orange surface.	Dominated by Grevillea gordoniana, Banksia ashbyi, Lamarchea.			Shark Bay	MAN	3	18/09/1989
1663615	2083	*Grevillea rogersoniana*	3	Arbor vel frutex usque 8 met. alt.; perianthium roseum.	In arenosis.	In fruticetis.			Prope [near] Shark Bay	AUTO	5	24/08/1961
1551825	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551876	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551892	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551868	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551841	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551884	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
1551833	2083	*Grevillea rogersoniana*	3	Fl. m. Aug. Septem. [Flowering mid-August to September].	In arenosis fruticetis.			Checked in C.A. Gardners collecting book. P. Breidahl 11/2/2009	Hab. in distr. Irwin. Septentrionalem versus ad Shark Bay [in Irwin district, N of and near to Shark Bay]	AUTO	5	24/08/1961
2118831	2083	*Grevillea rogersoniana*	3						Between Shark Bay and Hamelin Pool	AUTO	4	/7/1961
1900609	19192	*Grevillea sp. Shark Bay (N.H. Speck 24/09/1953)*	1						Shark's Bay,	AUTO	5	24/09/1953
4662555	3020	*Lepidium bipilcatum*	3	Erect herb 250 mm high x 200 mm wide. Pale pink flowers, 4 lobes, 4 calyx, 6 stamens, new and old leaves. Seeds green to brown when dry.	Valley - plain - birrida (salt flat). Crusted brown-yellow clay saline.	ß. Salt bush, Zygophyllum glaucum, Anglanthus sp., Commersonia gaudichaudii.	frequent.		32 km S of Denham, left on salt flat	TOPO	3	19/08/1996
5262771	3020	*Lepidium bipilcatum*	3		On cream sand with shell grit and 20% surface cover of litter, on very gently inclined, ENE-facing lower duneslope/swale.	Acacia ligulata/rostellifera-Melaleuca cardiophylla Open Low Scrub B over Atriplex paludosa-Rhagodia latifolia-R. cf preissii-Thryptomene sp Dense Low Heath D over Triodia bromoides-Austrostipa spp Mid-Dense Hummock Grass.			Edel Land, Shark Bay. c. 8.5 km SSE of Mt Direction, accessed by 4WD track to Thunder Bay, Blowholes & Crayfish (Epineux) Bay. [Plot-tbat01.]	MAN	0	18/09/1997
3396363	3020	*Lepidium bipilcatum*	3		Edge of salt pan in clay.				2 km W of Monkey Mia on road to Denham, Peron Peninsula	MAN	0	29/09/1985
5270162	3020	*Lepidium bipilcatum*	3		On deep, pale red silty sand with 5% limestone pebble surface cover and 20% surface cover of litter, on upland with westerly aspect.	Alyogyne cunelformis Open Low Scrub A over Melaleuca cardiophylla-Scaevola tomentosa -Eremophila oldfieldii ssp oldfieldii Dwarf Scrub C over Triodia pleurinervata Dense Hummock Grass.			Approximately 5.5 km SSW of Trig Station Useless, Heirisson Prong, Shark Bay. [Plot-hepr04.]	MAN	0	26/09/1997
3279588	3020	*Lepidium bipilcatum*	3						Dirk Hartog Island	AUTO	4	/09/1972
7107242	3020	*Lepidium bipilcatum*	3	Upright herb, 0.2 m high x 0.05 m wide. Four petal white flowers.	Flat. Limestone. Brown sand.	Hummock Grassland with Triodia.	frequent.	Just prior to first dunes on coast.	Blue metal track, Wilson Island; Shark Bay Area	TOPO	3	21/08/2004
1080393	3043	*Lepidium puberulum*	4		In sand, in small yard.				Cape Ransonnet, Dirk Hartog Island.	MAN	3	2/09/1972
5247411	3043	*Lepidium puberulum*	4		On deep, cream sand with 30% surface cover of litter, on dune crest.	Alyogyne cunelformis Open Low Scrub A over Melaleuca cardiophylla-M. huegelii -Diplolaena grandiflora Low Scrub B over Dense Low Heath C over Threlkeldia diffusa-Rhagodia preissii-R. latifolia-Thryptomene sp Low Heath D.			Steep Point, Shark Bay. Approximately 2.5 km SE of Mt Direction. [Plot-stpt04.]	MAN	0	21/09/1997
3297268	2841	*Macarthuria intricata*	3		Sandplain.	Among Banksia ashbyi.			Tamala road, on Nanga Station, Shark Bay	AUTO	3	26/08/1973
2695855	13270	*Melaleuca huegelii subsp. pristicensis*	3	Small ericoid shrub 3 ft, flowers mauve.		In Acacia ligulata scrub.			Inland of Sandy Point, Dirk Hartog Island	AUTO	3	18/10/1974
5252350	13270	*Melaleuca huegelii subsp. pristicensis*	3		On deep, white sand with shell grit and 10% surface cover of litter, on beach.	Melaleuca huegelii ssp pristicensis-Thryptomene sp Dense Low Heath C over Atriplex paludosa ssp moquiniana-Threlkeldia diffusa Open Dwarf Scrub D.			Approximately 2 km SW of Trig Station Spit, Heirisson Prong, Shark Bay. West of Rubberneck Rd. [Plot-hepr01.]	MAN	0	26/09/1997
2695863	13270	*Melaleuca huegelii subsp. pristicensis*	3	Large shrubs 3.5 ft.	Light tan sandy soil.				1 mile N of Sandy Point, Central, Dirk Hartog Island	AUTO	4	6/09/1967
6166822	13270	*Melaleuca huegelii subsp. pristicensis*	3		Dry sand.	Low shrubland. Thryptomene baeckeacea, Triodia, Melaleuca cardiophylla, Acacia ligulata.		Within area for proposed earth works	ca 500 m WSW of Useless Loop townsite	MAN	3	/06/1999
6101453	13270	*Melaleuca huegelii subsp. pristicensis*	3	Very wind blown.	Fringing inlet. Moist white sand.	Shrubland. Melaleuca huegelii subsp. pristicensis, scattered Zygophyllum fruticulosum, Nicotiana occidentalis subsp. hespesis.	dominant > 100 plants.		Shark Bay Salt Lease, Useless Loop	MAN	0	29/07/1996
1229591	13270	*Melaleuca huegelii subsp. pristicensis*	3	Shrub 2.8 m tall.	Undulating narrow band of shelly coarse calcareous sand, pale gre (brownish).	Low Melaleuca woodland.		Site 109.	Shark Bay.	MAN	0	4/10/1989
5263506	12639	*Olearia occidentissima*	2		On red sand with 40% surface cover of litter, on gentle, NE-facing lower slope above birrida.	Acacia sclerosperma Open Low Scrub A over A. ramulosa-A. tetragonophylla- Dodonea viscosa Dense Heath B over Scaevola spp-Stylobasium spathulatum Dwarf Scrub C over Acanthocarpus robustus-Ptilotus obovatus Dwarf Scrub D.			c. 22 km NNW of Peron Homestead, Peron Peninsula, Shark Bay. 400m S of fork in road to Herald Bight and Cape Peron, on W side of road. [Plot-pern03.]	MAN	0	11/10/1997
5250714	12639	*Olearia occidentissima*	2	In bud.	On red sand with limestone pavement and 30% surface cover of litter, on upland with ENE aspect.	Acacia spp-Santalum spicatum Open Scrub over Dodonea inaequifolia-Exocarpos aphyllus-Acacia tetragonophylla Heath B over Rhagodia latifolia-Ptilotus spp Dwarf Scrub over Enchylaena tomentosa-Maireana tomentosa Low Heath D.			Approximately 3 km west of Monkey Mia Jetty, Peron Peninsula, Shark Bay. West of track to water front north from Monkey Mia RD. [Plot-mmia01.]	MAN	0	14/10/1997
5263115	12639	*Olearia occidentissima*	2		On red silty clay with 90% surface cover of limestone outcrop, on gently sloping upland.	Acacia tetragonophylla-Pimelea microcephala Dwarf Scrub C over Diplolaena grandiflora-Atriplex bunburyana-Rhagodia latifolia-R. cf preissii-Ptilotus obovatus Low Heath D over Crassula colorata-Sonchus tenneriimus and other Herbs			4 km S to SSE of Useless Loop Township and Trig Station, Shark Bay. N of access road along beach. [Plot-uslp02.]	MAN	0	23/09/1997
5247519	12639	*Olearia occidentissima*	2		On pale orange-red sandy silt with shell grit and 30% surface cover of litter on NE-facing gentle lower slope on limestone fringing birrida.	Anthocercis littorea-Acacia tetragonophylla Open Low Scrub B over Atriplex paludosa ssp moquiniana-Olearia spp-Scaevola spp Dwarf Scrub C over Thryptomene sp-Melaleuca cardiophylla Dense Low Heath D over Very Open Herbs.			Near W edge large birrida c.11km SSW Useless Loop town. E side Rubberneck Rd & W side of side-track through birrida, 0.9km from edge. [Plot-bora01.]	MAN	0	27/09/1997
5268028	12639	*Olearia occidentissima*	2		On orange sand with 90% of surface cover limestone/sandstone cobbles and stones, on moderately steep upper slope of limestone bluff.	Bossiaea walkerii-Diplolaena grandiflora Low Heath C over Sida calyxhymeniana- Frankenia pauciflora-Ptilotus obovatus-Rhagodia latifolia Dwarf Scrub D over Austrostipa spp-Austrodanthonia caespitosa Very Open Grass.			Taillefer Isthmus, Shark Bay. Approximately 6 km NNW of repeater station site near Goulet Bluff. [Plot-whail01.]	MAN	0	15/10/1997

Sheet	Name ID	Taxon	Cons Code	Plant Description	Site	Vegetation	Frequency	Notes	Locality	Geo Method	Precision	Date
5264510	12639	*Olearia occidentissima*	2		On orange sand with 90% of surface cover limestone/sandstone cobbles and stones, on moderately steep upper slope of limestone bluff.	Bossiaea walkerii-Diplolaena grandiflora Low Heath C over Sida calyxhymeniana- Frankenia pauciflora-Ptilotus obovatus-Rhagodia latifolia Dwarf Scrub D over Austrostipa spp-Austrodanthonia caespitosa Very Open Grass.			Taillefer Isthmus, Shark Bay. Approximately 6 km NNW of repeater station site near Goulet Bluff. [Plot-whal01.]	MAN	0	15/10/1997
6000754	12639	*Olearia occidentissima*	2	Slender erect shrub; 1.5 m high. In bud.	Low sandy rise; red sand with limestone.	Very open low Acacia tetragonophylla shrubland with Triodia plurinervata grassland.	rare.		Faure Island; Shark Bay.	MAN	2	25/05/2000
7370946	12639	*Olearia occidentissima*	2	Prostrate open perennial shrub, 0.4 m high x 0.6 m wide. Flowers pink. Reproductive method: seeds.	Hillside. Road verge. Dry brown sand. Old soil disturbance.	Low shrubland. With GB 825.	one only.	Population structure: adult.	Stella Rowley Drive, 400 m from junction with Monkey Mia Road	GPS	1	7/03/2004
9061991	12639	*Olearia occidentissima*	2	Low shrub to 0.5 m tall.	Sand.		20+ plants.		C. 1 km NE of Denham, c. 200 m along Henfry Road from Monkey Mia Road near the wastewater treatment plant	GPS	1	19/08/2013
1620622	4677	*Phyllanthus fuernrohrii*	3		On limestone clifftop.				Quoin Bluff South, Dirk Hartog Island	MAN	0	3/09/1972
1620630	4677	*Phyllanthus fuernrohrii*	3		On limestone clifftop.				Quoin Bluff South, Dirk Hartog Island	MAN	0	3/09/1972
1869752	17208	*Physopsis chrysophylla*	3						? Shark Bay	AUTO	5	//
2693712	17208	*Physopsis chrysophylla*	3						Shark Bay District	AUTO	5	//
5263050	2692	*Ptilotus alexandri*	2		On cream sandy silt with greater than 5% surface cover of litter, on gently inclined, W-facing footslope at the back of dune.	Acacia tetragonophylla open Dwarf Scrub C over Melaleuca cardiophylla -Thryptomene sp Low Heath D over Triodia pleurinervata Dense Hummock Grass over Podolepis canescens-Lobelia heterophylla Very Open Herbs.			2.5 km approximately S of Useless Loop Township and Trig Station, Shark Bay. On E side of Useless Loop-Perth Rd. [Plot-usls05.]	MAN	0	8/10/1997
210749	2692	*Ptilotus alexandri*	2	Ephemeral herb; flowers pink	Sandy.	On open steppe among Plectrachne sp. and Acacia ligulata.			Dirk Hartog Island near Notch Point	MAN	3	7/09/1972
5263042	2692	*Ptilotus alexandri*	2		On deep, cream sand to silty sand on lowland plain.	Melaleuca cardiophylla-Thryptomene sp Low Heath D over Triodia bromoides Mid-Dense Hummock Grass over Waitzia podolepis-Senecio lautus Open Herbs			Steep Point, Shark Bay. Approximately 5 km SE of Monkey Rock. [Plot-stpt08.]	MAN	0	22/09/1997
5250331	2692	*Ptilotus alexandri*	2		On deep, cream sand to silty sand on lowland plain.	Melaleuca cardiophylla-Thryptomene sp Low Heath D over Triodia bromoides Mid-Dense Hummock Grass over Waitzia podolepis-Senecio lautus Open Herbs.			Steep Point, Shark Bay. Approximately 5 km SE of Monkey Rock. [Plot-stpt08.]	MAN	0	22/09/1997
4274598	12580	*Scaevola chrysopogon*	2	c. 50 cm high.	Brown sand.	Woodland.	one only.		7 km past Nanga [Homestead], right side of road	MAN	3	28/09/1992
5264693	12580	*Scaevola chrysopogon*	2		On deep, red sand with 40% surface cover of litter, on upland.	Acacia ligulata/rostellifera-A. ramulosa-Eremophila maitlandii-Grevillea stenobotrya Low Scrub A over Stylobasium spathulatum-Lechenaultia linarioides-Pimelea microcephala Heath B over Triodia Dense Hummock Grass			5 km ENE of Nanga Station Homestead. East of Nanga Bore and Yards, south of track. [Plot-nang01.]	MAN	0	3/10/1997
5251168	12580	*Scaevola chrysopogon*	2		On deep, red sand with 40% surface cover of litter, on upland.	Acacia ligulata/rostellifera-A. ramulosa-Eremophila maitlandii-Grevillea stenobotrya Low Scrub A over Stylobasium spathulatum-Lechenaultia linarioides-Pimelea microcephala Heath B over Triodia Dense Hummock Grass.			5 km ENE of Nanga Station Homestead, East of Nanga Bore and Yards, south of track, [Plot-nang01.]	MAN	0	3/10/1997
4924096	12730	*Sondottia glabrata*	2	Decumbent annual 5-10 cm high x 20 cm wide. Flowers yellow.	Low dunes, red sand over sand.	Acacia low shrubland.		Abundance: very common.	3 km S of Monkey Mia.	AUTO	3	27/08/1989
4196902	12730	*Sondottia glabrata*	2						Salt flat before Goulet Bluff	MAN	0	7/09/1993
1691791	12730	*Sondottia glabrata*	2	Annual. Leaves fleshy. Flowers yellow.	Growing in flat saline.	Chenopodiaceae steppe.			78 km from Overlander Roadhouse on Denham Road	TOPO	3	30/09/1989
415804	12730	*Sondottia glabrata*	2		Edge of salt pan in clay.				2 km W of Monkey Mia on road to Denham, Peron Peninsula	MAN	0	29/09/1985
6962343	12730	*Sondottia glabrata*	2	Erect herb 10 cm high. Fluffy flowers.	Flat. Dry red sand.	Scrub heath.	frequent.		Shark Bay, proposed gravel pit	GPS	1	29/09/2003
2470845	18111	*Spergularia nesophila*	3		In sand, in grazed area by mill.				Two Wells Mill, Dirk Hartog Island	MAN	0	2/09/1972
1221108	14241	*Stenanthemum divaricatum*	3		On small dune in birrida.	With Melaleuca cardiophylla, Loxocarya.		1 km north of Avicennia site.	Shark Bay	AUTO	5	8/10/1989
2189194	44701	*Thryptomene repens*	2	Sprawling shrub; flowers pink.	In sand, on steppe.				N side of Passage Paddock, Dirk Hartog [Island]	MAN	0	2/09/1972
7546378	44701	*Thryptomene repens*	2	Prostrate shrub spreading to 2 m, pink flowers.	Steep.	Heath. Eremophila splendens, Melaleuca cardiophylla, Scaevola crassifolia.			7 km from Steep Point at Blackies Beach	GPS	1	31/08/2005
7546351	44701	*Thryptomene repens*	2	Prostrate shrub to 1.05 wide x 10 cm high, pink flowers.	Rolling sand dunes, white sand.	Shrubs, heath. Hyalosperma glutinosum, Acacia sp., Atriplex sp.		Sampled from 50 plants.	14.2 km W of the causeway (4 wheel drive track) into Steep Point	TOPO	3	13/11/2005
3627853	17885	*Triodia bromoides*	4	Spinifex. = 7077.		In A. ligulata scrub.			Dirk Hartog Island near homestead	AUTO	4	17/10/1974
5249228	17885	*Triodia bromoides*	4		On deep, white sand with 60% surface cover of litter, on steep upper duneslope.	Acacia ligulata/rostellifera-Alyogyne cunelformis Low Scrub A over Beaufortia dampieri -Melaleuca cardiophylla-Pimelea microcephala-Thryptomene sp-Rhagodia spp Low Heath C over Threlkeldia diffusa Dwarf Scrub C over Grass.			Steep Point, Shark Bay. Approximately 7.5 km SE of Mt Direction. South of Steep Point Track and old fenceline. [Plot-stpt12.]	MAN	0	24/09/1997
5263131	17885	*Triodia bromoides*	4		On pale orange-red sandy silt with shell grit and 30% surface cover of litter on NE-facing gentle lower slope on limestone fringing birrida.	Anthocercis littorea-Acacia tetragonophylla Open Low Scrub B over Atriplex paludosa ssp moquiniana-Olearia spp-Scaevola spp Dwarf Scrub C over Thryptomene sp-Melaleuca cardiophylla Dense Low Heath D.			Near W edge large birrida c.11km SSW Useless Loop town. E side Rubberneck Rd & W side of side-track through birrida, 0.9km from edge. [Plot-bora01.]	MAN	0	27/09/1997
5263581	17885	*Triodia bromoides*	4		On cream sand with shell grit and 20% surface cover of litter, on very gently inclined, ENE-facing lower duneslope/swale.	Acacia ligulata/rostellifera-Melaleuca cardiophylla Open Low Scrub B over Atriplex paludosa-Rhagodia latifolia-R. cf preissii-Thryptomene sp Dense Low Heath D over Triodia bromoides-Austrostipa spp Mid-Dense Hummock Grass.			Edel Land, Shark Bay. c. 8.5 km SSE of Mt Direction, accessed by 4WD track to Thunder Bay, Blowholes & Crayfish (Epineux) Bay. [Plot-tbat01.]	MAN	0	18/09/1997
488259	17885	*Triodia bromoides*	4		On calcareous sand dunes.	In low woodland.			Biddy Criddy Camp to Mount Direction & Steep Point	MAN	0	13/08/1970
387851	17885	*Triodia bromoides*	4	In clumps, flowers straw-purple.	Sand.		common.		Ca 0.8 km W of Homestead, Dirk Hartog Island	MAN	0	3/09/1972
387878	17885	*Triodia bromoides*	4	In clumps, flowers straw-purple.	Sand.		common.		Ca 0.8 km W of Homestead, Dirk Hartog Island	MAN	0	3/09/1972
1232207	17885	*Triodia bromoides*	4			Melaleuca cardiophylla heathland. Vegetation equivalent to site 123.			500 m N of Site 129, Shark Bay	MAN	0	6/10/1989
1232762	17885	*Triodia bromoides*	4		E facing slope of large dunes; fine, grey (slightly brownish) calcareous sand.	Shrubland with Acacia rostellifera, Melaleuca cardiophylla, Thryptomene.			Site 111, Shark Bay	MAN	0	4/10/1989
574597	694	*Triodia plurinervata*	3			Hummock grassland.			Peron Station, 550 mile peg - road to Denham	MAN	4	11/07/1970
574503	694	*Triodia plurinervata*	3	Spinifex.		In wattle and spinifex.			Denham	AUTO	3	10/10/1973
574481	694	*Triodia plurinervata*	3	Spinifex.		In wattle and spinifex.			Denham	AUTO	3	10/10/1973
3196291	694	*Triodia plurinervata*	3	Spinifex, larger tussock than 7050.		In scrub, in shrub steppe.			10 miles S of Denham on Peron Peninsula	MAN	3	15/10/1974
574554	694	*Triodia plurinervata*	3					Label details checked against Blackall's collecting book. M.A. Lewington 20/3/2009.	Between Hamelin Pool and Shark Bay	AUTO	5	4/09/1940
1781308	694	*Triodia plurinervata*	3	Poussant en touffes hautes de 60 cm.					Shark Bay: Cararang Peninsula	AUTO	3	25/07/1988
1951556	694	*Triodia plurinervata*	3	Perennial grass, densely clumped, spiky < 1m; leaves bright green; flower heads and stems green turning purple/red.	Undulating, red sand.	Shrubland, Acacia.			Opposite Little Lagoon Look Out on Denham/Monkey Mia road, Peron National Park	AUTO	3	6/06/1991
574589	694	*Triodia plurinervata*	3	Caespitose hummock grass, 10 cm high. Leaves very pungent.	Gentle undulating dune complex. Red sand.	In hummock grassland.	abundant.		ExSB 645 Peron [Peninsula] Station	AUTO	3	11/11/1982
3196305	694	*Triodia plurinervata*	3	Spinifex.	In exposed position near sea.	In shrub steppe.			23 miles S of Denham on Peron Peninsula	TOPO	3	15/10/1974
3196313	694	*Triodia plurinervata*	3	Spinifex, small tussock.		In shrub steppe.			4 miles S of Denham on Peron Peninsula	TOPO	3	15/10/1974
574546	694	*Triodia plurinervata*	3	Tussocks, often annular, 30 cm high, 1 - 5 m broad.		Associated Acacia rostellifera.			14 miles SE Denham	TOPO	3	21/07/1957
574465	694	*Triodia plurinervata*	3	Spinifex.		In spinifex country.			Useless Loop	AUTO	3	11/10/1973
574511	694	*Triodia plurinervata*	3	Spinifex.		Spinifex country.			Useless Loop	MAN	3	11/10/1973
1232193	694	*Triodia plurinervata*	3		Crest of large dune; orange-brown siliceous sand.	Acacia ligulata/Melaleuca cardiophylla heath.		Near Peron site 41.	Peron Peninsula, Shark Bay.	MAN	2	4/11/1989
4446054	694	*Triodia plurinervata*	3		On all open steppes.	Among scrub. Triodia forms much of the harsh prickly low vegetation.			Dirk Hartog [Island]	AUTO	4	6/09/1967

Sheet	Name ID	Taxon	Cons Code	Plant Description	Site	Vegetation	Frequency	Notes	Locality	Geo Method	Precision	Date
1951548	694	*Triodia plurinervata*	3	Perennial grass, densely clumped, spiky <.1m; leaves bright green; flower heads and stems green turning purple/red.	Undulating, red sand.	Shrubland, Acacia.			Opposite Little Lagoon Look Out on Denham/Monkey Mia road, Peron National Park	AUTO	3	6/06/1991
1232738	694	*Triodia plurinervata*	3		West facing slope of fairly large dune; pale (dull) brown sand, fine mixed calcareous and siliceous sand with slightly setting surface.	Acacia ligulata shrubland.		Peron site 24.	Peron Peninsula, Shark Bay.	MAN	2	3/11/1989
5250668	694	*Triodia plurinervata*	3		On pale red sand on upland plain.	Acacia ligulata/rostellifera-Pimelea microcephala Open Low Scrub B over *P. microcephala*-Atriplex sp-Solanum orbiculatum-Stylobasium spathulatum Dwarf Scrub C over Triodia pleurinervata Dense Hummock Grass over Very Open Herbs			Peron Peninsula, Shark Bay. Approximately 6 km ESE of junction of Eagle Bluff Rd and Denham-Hamelin Rd. [Plot-ebwe01.]	MAN	0	2/10/1997
5250072	694	*Triodia plurinervata*	3		On pale red sand on upland plain.	Acacia ligulata/rostellifera-Pimelea microcephala Open Low Scrub B over *P. microcephala*-Atriplex sp-Solanum orbiculatum-Stylobasium spathulatum Dwarf Scrub C over Triodia pleurinervata Dense Hummock Grass over Very Open Herbs			Peron Peninsula, Shark Bay. Approximately 6 km ESE of junction of Eagle Bluff Rd and Denham-Hamelin Rd. [Plot-ebwe01.]	MAN	0	2/10/1997
5041872	694	*Triodia plurinervata*	3	Bunch grass.	Low dune, SE aspect. Red sand over sandy clay.	Acacia ligulata Open Low Scrub A over Pimelea microcephala, Ptilotus obovatus and Solanum orbiculare Low Scrub B over Brachycome latisquamea, Thryptomene baeckeacea Open Dwarf Scrub D over Triodia plurinervata Grass over Brassica tournefortii Open Herbs.			Francois Peron National Park, 4.1 km S of Peron Homestead W of road to Monkey Mia Road. (Site: pe2)	GPS	1	24/08/1994
8083738	694	*Triodia plurinervata*	3	Hummock grass, in ring.	Undulating, low dunes. Red-brown calcareous soil.	Shrubland of Acacia and chenopods.	dominant.		6 km from Denham towards Hamelin Pool, Irwin district	GPS	1	10/09/2004

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Colleen McDonald on 17/07/2019

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 113° 32' 58" E,25° 54' 39" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	434	1376
Priority 1	2	3
Priority 2	7	23
Priority 3	9	38
Priority 4	1	1
TOTAL	**453**	**1441**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Priority 1					
1.	18132	*Dicrastylis sp. Denham (M. Lewis 42/92)*		P1	Y
2.	19192	*Grevillea sp. Shark Bay (N.H. Speck 24/09/1953)*		P1	Y
Priority 2					
3.	14112	*Abutilon sp. Hamelin (A.M. Ashby 2196)*		P2	
4.	14114	*Abutilon sp. Quobba (H. Demarz 3858)*		P2	
5.	12616	*Chthonocephalus muellerianus*		P2	
6.	7934	*Chthonocephalus tomentellus*		P2	
7.	5945	*Melaleuca oldfieldii*		P2	
8.	12639	*Olearia occidentissima*		P2	
9.	12730	*Sondottia glabrata*		P2	
Priority 3					
10.	3309	*Acacia drepanophylla*		P3	
11.	1207	*Acanthocarpus parviflorus*		P3	
12.	6948	*Anthocercis intricata*		P3	
13.	30232	*Bossiaea calcicola*		P3	
14.	2083	*Grevillea rogersoniana (Rogersons' Grevillea)*		P3	
15.	3020	*Lepidium biplicatum*		P3	
16.	17208	*Physopsis chrysophylla*		P3	
17.	14241	*Stenanthemum divaricatum*		P3	
18.	694	*Triodia plurinervata*		P3	
Priority 4					
19.	13544	*Eucalyptus zopherophloia (Blackbutt Mallee)*		P4	
Non-conservation taxon					
20.	4889	*Abutilon cryptopetalum*			
21.	4892	*Abutilon geranioides*			
22.	43020	*Abutilon oxycarpum subsp. Prostrate (A.A. Mitchell PRP 1266)*			
23.	3208	*Acacia amblyophylla*			
24.	13072	*Acacia chartacea*			
25.	13500	*Acacia coriacea subsp. coriacea*			
26.	3323	*Acacia ericifolia*			
27.	3344	*Acacia galeata*			
28.	3355	*Acacia grasbyi (Miniritchie)*			
29.	11448	*Acacia leptospermoides subsp. leptospermoides*			
30.	3419	*Acacia ligulata (Umbrella Bush, Watarka)*			
31.	3510	*Acacia ramulosa (Horse Mulga)*			
32.	19499	*Acacia ramulosa var. ramulosa*			
33.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
34.	3534	*Acacia sclerosperma (Limestone Wattle)*			
35.	13078	*Acacia sclerosperma subsp. sclerosperma*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
36.	3549	*Acacia spathulifolia*			
37.	13070	*Acacia synchronicia*			
38.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
39.	3595	*Acacia victoriae (Bramble Wattle, Ngatunpa)*			
40.	3606	*Acacia xiphophylla*			
41.	1208	*Acanthocarpus preissii*			
42.	1209	*Acanthocarpus robustus*			
43.	1211	*Acanthocarpus verticillatus*			
44.	26441	*Acanthophora spicifera*			
45.	48409	*Acetabularia caliculus*			
46.	13146	*Acetabularia peniculus*			
47.	7814	*Actinobole condensatum*			
48.	7817	*Actinobole uliginosum (Flannel Cudweed)*			
49.	17422	*Adriana tomentosa var. tomentosa*			
50.	2646	*Aerva javanica (Kapok Bush)*	Y		
51.	1505	*Agave americana (Century Plant)*	Y		
52.	26450	*Aglaothamnion cordatum*			
53.	48513	*Aizoon pubescens*	Y		
54.	4739	*Alectryon oleifolius*			
55.	11487	*Alectryon oleifolius subsp. oleifolius*			
56.	4904	*Alyogyne cuneiformis (Coastal Hibiscus)*			
57.	4907	*Alyogyne pinoniana (Sand Hibiscus)*			
58.	13702	*Alyogyne pinoniana var. pinoniana*			
59.	2657	*Amaranthus clementii*			
60.	2369	*Amyema benthamii*			
61.	13266	*Amyema miraculosa subsp. miraculosa*			
62.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
63.	40914	*Androcalva gaudichaudii*			
64.	7822	*Angianthus acrohyalinus (Hook-leaf Angianthus)*			
65.	7827	*Angianthus cunninghamii (Coast Angianthus)*			
66.	7832	*Angianthus milnei (Cone-spike Angianthus)*			
67.	26469	*Anotrichium tenue*			
68.	2332	*Anthobolus foveolatus*			
69.	6949	*Anthocercis littorea (Yellow Tailflower)*			
70.	14178	*Anthocercis sp. Shark Bay (T.E.H. Aplin 3335)*			
71.	17797	*Argemone ochroleuca subsp. ochroleuca*	Y		
72.	207	*Aristida contorta (Bunched Kerosene Grass)*			
73.	210	*Aristida holathera*			
74.		*Aristida sp.*			
75.	26486	*Asparagopsis taxiformis*			
76.	1364	*Asphodelus fistulosus (Onion Weed)*	Y		
77.	2450	*Atriplex amnicola (Swamp Saltbush)*			
78.	2451	*Atriplex bunburyana (Silver Saltbush)*			
79.	2452	*Atriplex cinerea (Grey Saltbush)*			
80.	2459	*Atriplex holocarpa (Pop Saltbush)*			
81.	2470	*Atriplex paludosa (Marsh Saltbush)*			
82.	11698	*Atriplex paludosa subsp. moquiniana*			
83.	2476	*Atriplex semilunaris (Annual Saltbush)*			
84.	2481	*Atriplex vesicaria (Bladder Saltbush)*			
85.	17235	*Austrostipa crinita*			
86.	17237	*Austrostipa elegantissima*			
87.	17246	*Austrostipa nitida*			
88.	17251	*Austrostipa scabra*			
89.		*Austrostipa sp.*			
90.	6828	*Avicennia marina (White Mangrove)*			
91.	14555	*Avicennia marina subsp. marina*			
92.	1799	*Banksia ashbyi (Ashby's Banksia)*			
93.	19024	*Beaufortia sprengelioides (Shark Bay Beaufortia)*			
94.	4594	*Beyeria cinerea*			
95.	34237	*Beyeria cinerea subsp. borealis*			
96.	3722	*Bossiaea walkeri*			
97.	27376	*Bostrychia tenella subsp. tenella*			
98.	4999	*Brachychiton gregorii (Desert Kurrajong, Ngalta)*			
99.	7878	*Brachyscome iberidifolia*			
100.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
101.	247	*Bromus arenarius (Sand Brome)*			
102.	249	*Bromus diandrus (Great Brome)*	Y		
103.	750	*Bulbostylis barbata*			
104.	3167	*Bursaria occidentalis*			
105.	2856	*Calandrinia liniflora (Parakeelya)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
106.	2860	*Calandrinia polyandra (Parakeelya)*			
107.	31132	*Calandrinia sp. Truncate capsules (A. Markey & S. Dillon 3474)*			
108.	30396	*Calandrinia translucens*			
109.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
110.	26540	*Caloglossa monosticha*			Y
111.	5406	*Calothamnus formosus*			
112.	35856	*Calothamnus glaber*			
113.	5420	*Calothamnus oldfieldii*			
114.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
115.	5479	*Calytrix strigosa*			
116.	2797	*Carpobrotus rossii (Karkalla)*			
117.	2948	*Cassytha aurea*			
118.	12073	*Cassytha aurea var. aurea*			
119.	11351	*Cassytha aurea var. hirta*			
120.	2955	*Cassytha nodiflora*			
121.	26559	*Caulerpa cupressoides*			
122.	26568	*Caulerpa lentillifera*			
123.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
124.	259	*Cenchrus echinatus (Burrgrass)*	Y		
125.	7916	*Centaurea melitensis (Maltese Cockspur, Malta Thistle)*	Y		
126.	7922	*Cephalipterum drummondii (Pompom Head)*			
127.	26595	*Ceramium isogonum*			
128.	2489	*Chenopodium gaudichaudianum (Cottony Saltbush)*			
129.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
130.	26641	*Chondria succulenta*			
131.	7926	*Chondropyxis halophila*			
132.	13114	*Chorizema racemosum*			
133.	7933	*Chthonocephalus pseudevax (Woolly Groundheads)*			
134.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
135.	2776	*Commicarpus australis (Perennial Tar Vine)*			
136.	11979	*Conostylis candicans subsp. flavifolia*			
137.	6612	*Convolvulus clementii*			
138.	13560	*Corchorus crozophorifolius*			
139.	3137	*Crassula colorata (Dense Stonecrop)*			
140.	11563	*Crassula colorata var. colorata*			
141.	48280	*Cynanchum viminale subsp. australe*			
142.	809	*Cyperus rigidellus*			
143.	11723	*Dampiera incana var. incana*			
144.	6218	*Daucus glochidiatus (Australian Carrot)*			
145.	3796	*Daviesia benthamii*			
146.	1259	*Dianella revoluta (Blueberry Lily)*			
147.	11636	*Dianella revoluta var. divaricata*			
148.	18550	*Dicrastylis maritima*			
149.	2498	*Didymanthus roei*			
150.	4456	*Diplolaena grandiflora (Wild Rose)*			
151.	4746	*Diplopeltis huegelii*			
152.	4754	*Dodonaea aptera (Coast Hop-bush)*			
153.	4766	*Dodonaea inaequifolia*			
154.	11247	*Dodonaea viscosa subsp. angustissima*			
155.	31334	*Duperreya sericea*			
156.	2504	*Dysphania plantaginella*			
157.	2508	*Dysphania sphaerosperma*			
158.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
159.	2511	*Enchylaena tomentosa (Barrier Saltbush)*			
160.	12064	*Enchylaena tomentosa var. tomentosa (Barrier Saltbush)*			
161.	370	*Eragrostis barrelieri*	Y		
162.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
163.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*			
164.	392	*Eragrostis pergracilis*			
165.	13954	*Eremaea dendroidea*			
166.	2512	*Eremophea aggregata*			
167.	7189	*Eremophila clarkei (Turpentine Bush)*			
168.	14895	*Eremophila decipiens subsp. decipiens*			
169.	16696	*Eremophila fraseri subsp. fraseri*			
170.	7215	*Eremophila glabra (Tar Bush)*			
171.	17175	*Eremophila glabra subsp. albicans*			
172.	14340	*Eremophila glabra subsp. glabra*			
173.	17173	*Eremophila glabra subsp. psammophora*			
174.	14191	*Eremophila glabra subsp. tomentosa*			
175.	16734	*Eremophila mackinlayi subsp. mackinlayi*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
176.	7238	*Eremophila maitlandii (Shark Bay Poverty Bush)*			
177.	7246	*Eremophila oldfieldii (Pixie Bush)*			
178.	17168	*Eremophila oldfieldii subsp. oldfieldii*			
179.	7247	*Eremophila oppositifolia (Weeooka)*			
180.	15155	*Eremophila youngii subsp. youngii*			
181.	417	*Eriachne pulchella (Pretty Wanderrie)*			
182.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
183.	4335	*Erodium cygnorum (Blue Heronsbill)*			
184.	14376	*Erymophyllum ramosum subsp. involucratum*			
185.	33519	*Eucalyptus baiophylla*			
186.	5649	*Eucalyptus foecunda (Narrow-leaved Red Mallee)*			
187.	5654	*Eucalyptus fruticosa*			
188.	13018	*Eucalyptus mannensis subsp. vespertina*			
189.	5722	*Eucalyptus obtusiflora (Dongara Mallee)*			
190.	5730	*Eucalyptus oraria (Ooragmandee)*			
191.	5752	*Eucalyptus prominens*			
192.	5761	*Eucalyptus rigidula (Stiff-leaved Mallee)*			
193.	5762	*Eucalyptus roycei (Shark Bay Mallee)*			
194.	11011	*Eulalia aurea*			
195.	4617	*Euphorbia australis (Namana)*			
196.	35307	*Euphorbia australis var. australis*			
197.	4620	*Euphorbia boophthona (Gascoyne Spurge)*			
198.	4626	*Euphorbia drummondii (Caustic Weed, Piwi)*			
199.	42868	*Euphorbia philochalix*			
200.	4644	*Euphorbia sharkoensis*			
201.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
202.	10977	*Exocarpos aphyllus (Leafless Ballart)*			
203.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
204.	5209	*Frankenia pauciflora (Seaheath)*			
205.	5212	*Frankenia setosa (Bristly Frankenia)*			
206.	26841	*Gayralia oxysperma*			
207.	32373	*Gemmabryum austrosabulosum*			
208.	3938	*Glycine canescens (Silky Glycine)*			
209.	7988	*Gnephosis arachnoidea (Cobwebby-headed Gnephosis)*			
210.	7989	*Gnephosis brevifolia (Short-leaved Gnephosis)*			
211.	7995	*Gnephosis gynotricha*			
212.	8002	*Gnephosis tenuissima*			
213.	7495	*Goodenia berardiana*			
214.	7514	*Goodenia havilandii*			
215.	12554	*Goodenia ochracea*			
216.	2001	*Grevillea eriostachya (Flame Grevillea, Kaliny-kalinypa)*			
217.	13430	*Grevillea hakeoides subsp. stenophylla*			
218.	2096	*Grevillea stenobotrya*			
219.	36358	*Griffithsia heteromorpha*			
220.	2810	*Gunniopsis septifraga*			
221.	2784	*Gyrostemon ramulosus (Corkybark)*			
222.	17557	*Hakea recurva subsp. recurva*			
223.	2207	*Hakea stenophylla*			
224.	18060	*Hakea stenophylla subsp. notialis*			
225.	16897	*Hakea stenophylla subsp. stenophylla*			
226.	29840	*Halgania cyanea var. Allambi Stn (B.W. Strong 676)*			
227.	6691	*Halgania integerrima*			
228.	6693	*Halgania littoralis*			
229.	26894	*Halimeda macroloba*			
230.	131	*Halodule uninervis*			
231.	164	*Halophila ovalis (Sea Wrack)*			
232.	23464	*Haloragis gossei var. inflata*			
233.	6180	*Haloragis trigonocarpa*			
234.	17781	*Hannafordia quadrivalvis subsp. quadrivalvis*			
235.	17782	*Hannafordia quadrivalvis subsp. recurva*			
236.	8008	*Helianthus annuus (Sunflower, Common Sunflower)*	Y		
237.	17299	*Heliotropium ammophilum*			
238.	6707	*Heliotropium curassavicum (Smooth Heliotrope)*			
239.	4927	*Hibiscus drummondii (Drummond's Hibiscus)*			
240.	4942	*Hibiscus sturtii (Sturt's Hibiscus)*			
241.	11893	*Hibiscus sturtii var. truncatus*			
242.	449	*Hordeum leporinum (Barley Grass)*	Y		
243.	15448	*Hyalosperma glutinosum subsp. venustum*			
244.	26970	*Hypnea pannosa*			
245.	3971	*Indigofera boviperda*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
246.	3974	*Indigofera georgei (Bovine Indigo)*			
247.	45493	*Indigofera melanosticta*			
248.	11312	*Ipomoea pes-caprae subsp. brasiliensis*			
249.	14627	*Isotropis sp. Shark Bay (M.E. Trudgen 7170)*			
250.	6500	*Jasminum calcareum*			
251.	29056	*Jasminum sp. Exmouth (G. Marsh 77)*			
252.	4044	*Kennedia prostrata (Scarlet Runner)*			
253.	3664	*Labichea cassioides*			
254.	5845	*Lamarchea hakeifolia*			
255.	11772	*Lamarchea hakeifolia var. hakeifolia*			
256.	48408	*Laurencia dendroidea*			
257.	13289	*Lawrencella davenportii*			
258.	4953	*Lawrencia densiflora*			
259.	4960	*Lawrencia viridigrisea*			
260.	7580	*Lechenaultia linarioides (Yellow Leschenaultia)*			
261.	7588	*Lechenaultia subcymosa (Wide-branching Leschenaultia)*			
262.	3029	*Lepidium linifolium*			
263.	3044	*Lepidium rotundum (Veined Peppercress)*			
264.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
265.	36863	*Lobelia heterophylla subsp. heterophylla*			
266.	36880	*Lobelia heterophylla subsp. pilbarensis*			
267.	1224	*Lomandra collina (Pale Mat Rush)*			
268.	1231	*Lomandra maritima*			
269.	4060	*Lotus australis (Austral Trefoil)*			
270.	4061	*Lotus cruentus (Redflower Lotus)*			
271.	2396	*Lysiana casuarinae*			
272.		*Lysiana linearifolia*			Y
273.	2535	*Maireana appressa*			
274.	2537	*Maireana brevifolia (Small Leaf Bluebush)*			
275.	2556	*Maireana planifolia (Low Bluebush)*			
276.	2564	*Maireana stipitata*			
277.	2567	*Maireana tomentosa (Felty Bluebush)*			
278.	11662	*Maireana tomentosa subsp. tomentosa*			
279.	2568	*Maireana trichoptera (Downy Bluebush)*			
280.	5863	*Malleostemon pedunculatus*			
281.	12949	*Marsdenia australis*			
282.	16538	*Marsdenia graniticola*			
283.	15063	*Melaleuca acuminata subsp. acuminata*			
284.	5887	*Melaleuca cardiophylla (Tangling Melaleuca)*			
285.	5908	*Melaleuca eleuterostachya*			
286.	19452	*Melaleuca eulobata*			
287.	19525	*Melaleuca keigheryi*			
288.	5930	*Melaleuca leiopyxis*			
289.	36437	*Microbryum davallianum*			
290.	8105	*Millotia myosotidifolia*			
291.	8110	*Minuria leptophylla (Minnie Daisy)*			
292.	41444	*Mirbelia balsiformis*			
293.	4097	*Mirbelia ramulosa*			
294.	6490	*Muellerolimon salicorniaceum*			
295.	7291	*Myoporum insulare (Blueberry Tree, boobialla)*			
296.	6974	*Nicotiana glauca (Tree Tobacco)*	Y		
297.	6976	*Nicotiana occidentalis (Native Tobacco)*			
298.	11327	*Nicotiana occidentalis subsp. hesperis*			
299.	11331	*Nicotiana occidentalis subsp. obliqua*			
300.	11856	*Nicotiana occidentalis subsp. occidentalis*			
301.	4366	*Nitraria billardierei (Nitre Bush)*			
302.	16390	*Oenothera drummondii subsp. drummondii*	Y		
303.	8127	*Olearia axillaris (Coastal Daisybush)*			
304.	8145	*Olearia pimeleoides (Pimelea Daisybush, Burrobunga)*			
305.	42024	*Olearia sp. Kennedy Range (G. Byrne 66)*			
306.	18256	*Opercularia spermacocea*			
307.	12782	*Ophioglossum gramineum*			
308.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
309.	513	*Paractaenum novae-hollandiae (Reflexed Panic Grass)*			
310.	11232	*Paractaenum novae-hollandiae subsp. novae-hollandiae*			
311.	1762	*Parietaria debilis (Pellitory)*			
312.	524	*Paspalidium reflexum*			
313.	5226	*Passiflora foetida (Stinking Passion Flower)*	Y		
314.	20611	*Pembertonia latisquamea*			
315.	27121	*Penicillus nodulosus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
316.	15627	*Persoonia bowgada*			
317.	4675	*Phyllanthus calycinus (False Boronia)*			
318.	17626	*Phyllanthus erwinii*			
319.	18250	*Pileanthus vernicosus*			
320.	5246	*Pimelea gilgiana*			
321.	5256	*Pimelea microcephala (Shrubby Riceflower, Banjine)*			
322.	11185	*Pimelea microcephala subsp. microcephala*			
323.	5263	*Pimelea sessilis*			
324.	41300	*Pittosporum phillyreoides (Weeping Pittosporum, Yaliti)*			
325.	45240	*Podolepis aristata subsp. auriculata*			
326.	8173	*Podolepis capillaris (Wiry Podolepis)*			
327.	8174	*Podolepis gardneri*			
328.	8178	*Podolepis microcephala*			
329.	8182	*Podotheca angustifolia (Sticky Longheads)*			
330.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
331.		*Podotheca sp.*			
332.		*Polymeria sp.*			
333.	27178	*Polysiphonia scopulorum*			
334.	27182	*Polysiphonia teges*			
335.	2717	*Ptilotus divaricatus (Climbing Mulla Mulla)*			
336.	48602	*Ptilotus eremita*			
337.	2721	*Ptilotus exaltatus (Tall Mulla Mulla)*			
338.	2727	*Ptilotus gaudichaudii*			
339.	2729	*Ptilotus grandiflorus*			
340.	2747	*Ptilotus obovatus (Cotton Bush)*			
341.	11396	*Ptilotus obovatus var. obovatus*			
342.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
343.	2766	*Ptilotus villosiflorus*			
344.	41041	*Quoya atriplicina*			
345.	41043	*Quoya cuneata*			
346.	3061	*Raphanus raphanistrum (Wild Radish)*	Y		
347.	8197	*Reichardia tingitana (False Sowthistle)*	Y		
348.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
349.	2583	*Rhagodia latifolia*			
350.	11728	*Rhagodia latifolia subsp. latifolia*			
351.	2584	*Rhagodia preissii*			
352.	11240	*Rhagodia preissii subsp. obovata*			
353.	13300	*Rhodanthe citrina*			
354.	13291	*Rhodanthe condensata*			
355.	13246	*Rhodanthe humboldtiana*			
356.	13238	*Rhodanthe maryonii*			
357.	13249	*Rhodanthe oppositifolia subsp. oppositifolia*			
358.	13296	*Rhodanthe polycephala*			
359.	13254	*Rhodanthe stricta*			
360.		*Riccia albida*			
361.	45154	*Roebuckiella cheilocarpa var. cheilocarpa*			
362.	48887	*Roepera billardierei*			
363.	48898	*Roepera ovata*			
364.	11151	*Rostraria pumila*	Y		
365.	46434	*Rumex hypogaeus*	Y		
366.	2443	*Rumex vesicarius (Ruby Dock)*	Y		
367.	48430	*Salicornia quinqueflora*			
368.	2356	*Santalum acuminatum (Quandong, Warnga)*			
369.	2359	*Santalum spicatum (Sandalwood, Wilarak)*			
370.	4706	*Sauropus crassifolius*			
371.	7595	*Scaevola anchusifolia*			
372.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
373.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
374.	7648	*Scaevola tomentosa (Raggedleaf Fanflower)*			
375.	41660	*Schenkia australis*			
376.	8200	*Schoenia cassiniana (Schoenia)*			
377.	1002	*Schoenus nanus (Tiny Bog Rush)*			
378.	16254	*Schoenus sp. G Broad Sheath (K.L. Wilson 2633)*			
379.	44567	*Scholtzia obovata*			
380.	2609	*Sclerolaena diacantha (Grey Copperburr)*			
381.	2612	*Sclerolaena eurotioides (Fluffy Bindii)*			
382.	2628	*Sclerolaena recurvicuspis*			
383.	2633	*Sclerolaena uniflora (Two-spined Saltbush)*			
384.	12276	*Senna artemisioides subsp. filifolia*			
385.	12279	*Senna artemisioides subsp. helmsii*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
386.	12305	*Senna glutinosa subsp. chatelainiana*			
387.	12308	*Senna glutinosa subsp. x luerssenii*			
388.	16378	*Senna pleurocarpa*			
389.	12314	*Senna pleurocarpa var. pleurocarpa*			
390.	14577	*Senna sp. Meekatharra (E. Bailey 1-26)*			
391.	46818	*Seringia hermanniifolia (Crinkle-leaved firebush)*			
392.	606	*Setaria dielsii (Diels' Pigeon Grass)*			
393.	4970	*Sida calyxhymenia (Tall Sida)*			
394.	4982	*Sida kingii*			
395.	15972	*Silene gallica var. gallica*	Y		
396.	3069	*Sisymbrium erysimoides (Smooth Mustard)*	Y		
397.	7011	*Solanum hesperium*			
398.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
399.	7023	*Solanum nummularium (Money-leaved Solanum)*			
400.	7025	*Solanum oldfieldii*			
401.	7026	*Solanum orbiculatum (Wild Tomato)*			
402.	11241	*Solanum orbiculatum subsp. orbiculatum (Round-leaved Solanum)*			
403.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
404.	625	*Spinifex longifolius (Beach Spinifex)*			
405.	44523	*Spongophloea tissotii*			
406.	635	*Sporobolus virginicus (Marine Couch)*			
407.	27310	*Spyridia filamentosa*			
408.	43601	*Stackhousia sp. Mid west coastal (D. & B. Bellairs 6561)*			
409.	16190	*Stenanthemum complicatum*			
410.	3079	*Stenopetalum pedicellare*			
411.	3182	*Stylobasium spathulatum (Pebble Bush)*			
412.	43203	*Surreya diandra*			
413.	4220	*Swainsona canescens (Grey Swainsona)*			
414.	4231	*Swainsona kingii*			
415.	4242	*Swainsona pterostylis*			
416.	14629	*Swainsona sp. Shark Bay (M.E. Trudgen 7588)*			
417.	7363	*Synaptantha tillaeacea*			
418.	15741	*Tamarix aphylla (Athel Tree)*	Y		
419.	31616	*Tecticornia auriculata*			
420.	33236	*Tecticornia halocnemoides (Shrubby Samphire)*			
421.	33319	*Tecticornia indica subsp. bidens*			
422.	31674	*Tecticornia peltata*			
423.	33220	*Tecticornia pterygosperma subsp. denticulata*			
424.	2821	*Tetragonia diptera*			
425.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
426.	6051	*Thryptomene baeckeacea*			
427.	44710	*Thryptomene dampieri*			
428.	1319	*Thysanotus arenarius*			
429.	46756	*Thysanotus exfimbriatus*			
430.	1338	*Thysanotus manglesianus (Fringed Lily)*			
431.	1343	*Thysanotus patersonii*			
432.	1352	*Thysanotus speckii*			
433.	32444	*Tortula atrovirens*			
434.	6272	*Trachymene elachocarpa*			
435.	4376	*Tribulus forrestii*			
436.	12652	*Trichanthodium skirrophorum*			
437.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
438.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
439.	29477	*Tricoryne sp. Mullewa (G.J. Keighery 12080)*			
440.	33676	*Triglochin calcitrapa*			
441.	17882	*Triodia danthonioides*			
442.	706	*Triraphis mollis (Needle Grass)*			
443.	35263	*Ulva flexuosa*			
444.	45965	*Ulvella viridis*			Y
445.	8254	*Urospermum picroides (False Hawkbit)*	Y		
446.	48986	*Vincetoxicum lineare*			
447.	11387	*Vittadinia cervicularis var. cervicularis*			
448.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
449.	8279	*Waitzia corymbosa*			
450.	13328	*Waitzia nitida*			
451.	8281	*Waitzia podolepis*			
452.	1397	*Wurmbea inframediana*			
453.	1400	*Wurmbea odorata*			

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

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

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

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

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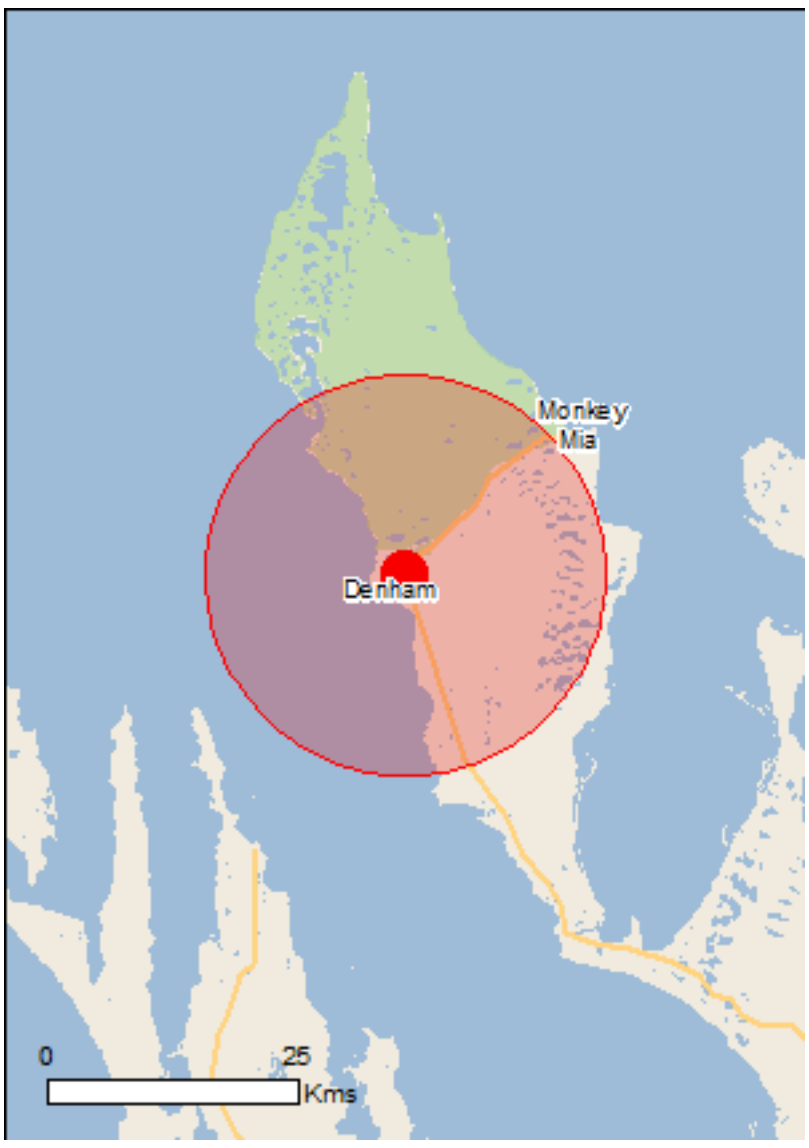

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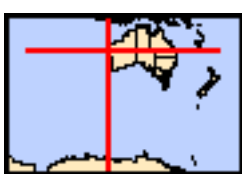

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	33
Listed Migratory Species:	51

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	79
Whales and Other Cetaceans:	10
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Shark Bay, Western Australia	WA	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Shark Bay, Western Australia	WA	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Plants		
Eucalyptus beardiana Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia		
Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus		
Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding likely to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta		
Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
[Trachyrhamphus bicoarctatus](#)		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Mammals		
[Dugong dugon](#)		
Dugong [28]		Species or species habitat known to occur within area
Reptiles		
[Aipysurus laevis](#)		
Olive Seasnake [1120]		Species or species habitat may occur within area
[Aipysurus pooleorum](#)		
Shark Bay Seasnake [66061]		Species or species habitat may occur within area
[Caretta caretta](#)		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
[Chelonia mydas](#)		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
[Dermochelys coriacea](#)		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Disteira kingii](#)		
Spectacled Seasnake [1123]		Species or species habitat may occur within area
[Disteira major](#)		
Olive-headed Seasnake [1124]		Species or species habitat may occur within area
[Emydocephalus annulatus](#)		
Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
[Ephalophis greyi](#)		
North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
[Hydrophis elegans](#)		
Elegant Seasnake [1104]		Species or species habitat may occur within area
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
[Pelamis platurus](#)		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
[Balaenoptera acutorostrata](#)		
Minke Whale [33]		Species or species habitat may occur within area
[Balaenoptera edeni](#)		
Bryde's Whale [35]		Species or species habitat may occur within area
[Delphinus delphis](#)		
Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Name	Status	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Francois Peron	WA
Monkey Mia Reserve	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Shark Bay East	WA

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-25.91088 113.54934

Acknowledgements

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

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

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

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

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Colleen McDonald on 17/07/2019

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	113° 32' 58" E,25° 54' 39" S
Buffer	20km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	296	2873
Other specially protected fauna	1	2
Priority 1	1	7
Priority 3	1	1
Priority 4	3	65
Protected under international agreement	20	244
Rare or likely to become extinct	13	120
TOTAL	**335**	**3312**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
2.	33999	*Calamanthus campestris subsp. hartogi (Dirk Hartog Island rufous fieldwren, Rufous Fieldwren (Dirk Hartog Is))*		T	
3.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
4.	24790	*Calidris tenuirostris (Great Knot)*		T	
5.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
6.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		T	
7.	25576	*Charadrius mongolus (Lesser Sand Plover)*		T	
8.	25336	*Chelonia mydas (Green Turtle)*		T	
9.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
10.	25107	*Egernia stokesii subsp. badia (Western Spiny-tailed Skink, Gidgee Skink)*		T	
11.	24557	*Leipoa ocellata (Malleefowl)*		T	
12.	24168	*Macrotis lagotis (Bilby, Dalgyte, Ninu)*		T	
13.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
Protected under international agreement					
14.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
15.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
16.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
17.	24780	*Calidris alba (Sanderling)*		IA	
18.	25738	*Calidris canutus (Red Knot, knot)*		IA	
19.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
20.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
21.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
22.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
23.	25742	*Numenius phaeopus (Whimbrel)*		IA	
24.	24497	*Oceanites oceanicus (Wilson's Storm-petrel)*		IA	
25.	41347	*Onychoprion anaethetus (Bridled Tern)*		IA	
26.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
27.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
28.	25642	*Sterna hirundo (Common Tern)*		IA	
29.	48597	*Thalasseus bergii (Crested Tern)*		IA	
30.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
31.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
32.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
33.	41351	*Xenus cinereus (Terek Sandpiper)*		IA	
Other specially protected fauna					
34.	24084	*Dugong dugon (Dugong)*		S	
Priority 1					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
35.	47673	*Aspidites ramsayi subsp. (southwest subpop.) (Woma (southwest subpop.))*		P1	
Priority 3					
36.	25006	*Pletholax gracilis subsp. edelensis (Keeled Legless Lizard (Shark Bay))*		P3	
Priority 4					
37.	25648	*Amytornis textilis (Thick-billed Grasswren)*		P4	
38.	24541	*Amytornis textilis subsp. textilis (Western Grasswren, Thick-billed Grasswren (western))*		P4	
39.	24803	*Tringa brevipes (Grey-tailed Tattler)*		P4	
Non-conservation taxon					
40.		*? ?*			
41.		*Abudefduf bengalensis*			
42.		*Abudefduf sp.*			
43.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
44.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
45.	25527	*Acanthiza iredalei (Samphire Thornbill, Slender-billed Thornbill)*			
46.	24263	*Acanthiza iredalei subsp. iredalei (Samphire Thornbill, Slender-billed Thornbill)*			
47.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
48.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
49.	25536	*Accipiter fasciatus (Brown Goshawk)*			
50.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
51.	25356	*Aipysurus pooleorum (Shark Bay Seasnake)*			
52.	25357	*Aipysurus tenuis (Brown-lined Seasnake)*			
53.		*Amblygobius phalaena*			
54.		*Amniataba caudavittata*			
55.	30833	*Amphibolurus longirostris (Long-nosed Dragon)*			
56.		*Aname mainae*			
57.	24312	*Anas gracilis (Grey Teal)*			
58.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
59.		*Apogon rueppellii*			
60.		*Apogon sp.*			
61.		*Apogon victoriae*			
62.	24285	*Aquila audax (Wedge-tailed Eagle)*			
63.		*Araneus eburneiventris*			
64.	41324	*Ardea modesta (great egret, white egret)*			
65.	24341	*Ardea pacifica (White-necked Heron)*			
66.	24610	*Ardeotis australis (Australian Bustard)*			
67.		*Argiope protensa*			
68.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
69.	25567	*Artamus leucorynchus (White-breasted Woodswallow)*			
70.		*Asadipus phaleratus*			
71.	25236	*Aspidites ramsayi (Woma)*			
72.		*Assiculus punctatus*			
73.		*Austrammo harveyi*			
74.		*Backobourkia collina*			
75.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
76.	47897	*Butorides striata (Striated Heron, Mangrove Heron)*			
77.	25716	*Cacatua sanguinea (Little Corella)*			
78.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
79.	24269	*Calamanthus campestris (Rufous Fieldwren)*			
80.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
81.		*Carcharhinus brevipinna*			
82.		*Carcharhinus sp.*			
83.		*Centrogenys vaigiensis*			
84.		*Cercophonius granulosus*			
85.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
86.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
87.	25339	*Chelodina steindachneri (Flat-shelled Turtle)*			
88.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
89.		*Chiloscyllium punctatum*			
90.		*Choerodon rubescens*			
91.		*Choerodon sp.*			
92.		*Chroicocephalus novaehollandiae*			
93.	24289	*Circus assimilis (Spotted Harrier)*			
94.		*Clubiona laudabilis*			
95.		*Clynotis albobarbatus*			
96.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
97.		*Colurodontis paxmani*			
98.		*Congrogadus subducens*			
99.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
100.		*Cormocephalus aurantiipes*			
101.	24416	*Corvus bennetti (Little Crow)*			
102.	25592	*Corvus coronoides (Australian Raven)*			
103.	25593	*Corvus orru (Torresian Crow)*			
104.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
105.	25596	*Cracticus torquatus (Grey Butcherbird)*			
106.		*Craterocephalus pauciradiatus*			
107.		*Cristiceps sp.*			
108.		*Cryptoerithus harveyi*			
109.		*Cryptoerithus occultus*			
110.		*Cryptoerithus quobba*			
111.	25460	*Ctenophorus maculatus (Spotted Military Dragon)*			
112.	24881	*Ctenophorus maculatus subsp. maculatus (Spotted Military Dragon)*			
113.	24886	*Ctenophorus reticulatus (Western Netted Dragon)*			
114.	24889	*Ctenophorus scutulatus (Lozenge-marked Dragon)*			
115.	25039	*Ctenotus fallens*			
116.	25074	*Ctenotus schomburgkii*			
117.	25087	*Cyclodomorphus celatus (Western Slender Blue-tongue)*			
118.		*Cymbacephalus nematophthalmus*			
119.		*Cynoglossus maculipinnis*			
120.		*Dactylopus dactylopus*			
121.	24997	*Delma butleri*			
122.	25001	*Delma nasuta*			
123.	25292	*Demansia calodera (Black-necked Whipsnake)*			
124.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
125.		*Dingosa serrata*			
126.	25231	*Diplodactylus klugei*			
127.	24938	*Diplodactylus ornatus*			
128.	24940	*Diplodactylus pulcher*			
129.	24470	*Dromaius novaehollandiae (Emu)*			
130.		*Drombus lepidothorax*			
131.	24650	*Drymodes brunneopygia (Southern Scrub-robin)*			
132.		*Egretta novaehollandiae*			
133.		*Elanus axillaris*			
134.		*Eolophus roseicapillus*			
135.		*Epinephelus coioides*			
136.	24567	*Epthianura albifrons (White-fronted Chat)*			
137.	24568	*Epthianura aurifrons (Orange Chat)*			
138.		*Ethmostigmus curtipes*			
139.		*Euristhmus microceps*			
140.		*Eviota sp.*			
141.	25621	*Falco berigora (Brown Falcon)*			
142.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
143.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
144.	25623	*Falco longipennis (Australian Hobby)*			
145.		*Favonigobius lateralis*			
146.		*Favonigobius sp.*			
147.	24041	*Felis catus (Cat)*	Y		
148.		*Festucalex scalaris*			
149.		*Festucalex sp.*			
150.	25727	*Fulica atra (Eurasian Coot)*			
151.	42314	*Gavicalis virescens (Singing Honeyeater)*			
152.	24959	*Gehyra variegata*			
153.	24401	*Geopelia cuneata (Diamond Dove)*			
154.	24443	*Grallina cyanoleuca (Magpie-lark)*			
155.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
156.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
157.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
158.		*Halichoeres brownfieldi*			
159.		*Halichoeres sp.*			
160.		*Heteroclinus sp.*			
161.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
162.		*Heteropoda hermitis*			
163.		*Heteropoda kalbarri*			
164.	47965	*Hieraaetus morphnoides (Little Eagle)*			
165.	25734	*Himantopus himantopus (Black-winged Stilt)*			
166.		*Hippocampus angustus*			
167.	24491	*Hirundo neoxena (Welcome Swallow)*			
168.		*Hoggicosa bicolor*			
169.		*Hoggicosa castanea*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
170.		*Holasteron humphreysi*			
171.		*Holconia nigrigularis*			
172.	25366	*Hydrophis elegans (Elegant Seasnake, Bar-bellied Seasnake)*			
173.	44656	*Hydrophis major (Olive-headed seasnake, greater seasnake)*			
174.	43384	*Hydrophis platurus (Yellow-bellied Seasnake)*			
175.		*Hypopterus macropterus*			
176.		*Isometroides vescus*			
177.		*Labracinus lineatus*			
178.		*Lactoria concatenatus*			
179.		*Lampona quinqueplagiata*			
180.		*Lamponina elongata*			
181.		*Lamponina scutata*			
182.	25638	*Larus pacificus (Pacific Gull)*			
183.	24512	*Larus pacificus subsp. georgii (Pacific Gull)*			
184.		*Latrodectus hasseltii*			
185.	25129	*Lerista connivens*			
186.	25133	*Lerista elegans*			
187.	25148	*Lerista lineopunctulata*			
188.	25482	*Lerista macropisthopus*			
189.	25151	*Lerista macropisthopus subsp. fusciceps*			
190.	30922	*Lerista micra*			
191.	25484	*Lerista planiventralis*			
192.	25160	*Lerista planiventralis subsp. decora*			
193.	25165	*Lerista praepedita*			
194.	25176	*Lerista uniduo (Spotted Broad-blazed Slider, skink)*			
195.	25177	*Lerista varia*			
196.		*Lethrinus laticaudis*			
197.	25005	*Lialis burtonis*			
198.		*Lissocampus fatiloquus*			
199.	42414	*Lucasium alboguttatum*			
200.		*Lutjanus fulviflamma*			
201.		*Mainosa longipes*			
202.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
203.	24544	*Malurus lamberti subsp. assimilis (Variegated Fairy-wren)*			
204.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
205.	24549	*Malurus leucopterus subsp. leuconotus (White-winged Fairy-wren)*			
206.	25654	*Malurus splendens (Splendid Fairy-wren)*			
207.	24583	*Manorina flavigula (Yellow-throated Miner)*			
208.	47997	*Melanodryas cucullata (Hooded Robin)*			
209.	24736	*Melopsittacus undulatus (Budgerigar)*			
210.		*Mene maculata*			
211.	25184	*Menetia greyii*			
212.	25186	*Menetia surda subsp. cresswelli*			
213.		*Microcanthus strigatus*			
214.		*Microcarbo melanoleucos*			
215.	25542	*Milvus migrans (Black Kite)*			
216.	24904	*Moloch horridus (Thorny Devil)*			
217.		*Monacanthus chinensis*			
218.	25191	*Morethia lineoocellata*			
219.		*Mugil cephalus*			
220.		*Mugil sp.*			
221.	24223	*Mus musculus (House Mouse)*	Y		
222.		*Myandra bicincta*			
223.	24450	*Myiagra ruficollis subsp. mimikae (Broad-billed Flycatcher)*			
224.	24739	*Neophema petrophila (Rock Parrot)*			
225.		*Nephila edulis*			
226.	25497	*Nephrurus levis*			
227.	24967	*Nephrurus levis subsp. levis*			
228.	24968	*Nephrurus levis subsp. occidentalis*			
229.		*Nicodamus mainae*			
230.		*Nomindra leeuweni*			
231.		*Notograptus sp.*			
232.	24224	*Notomys alexis (Spinifex Hopping-mouse)*			
233.		*Notsodipus meedo*			
234.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
235.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
236.	24742	*Nymphicus hollandicus (Cockatiel)*			
237.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
238.		*Omobranchus rotundiceps*			
239.		*Omobranchus sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
240.		*Opisthoncus devexus*			Y
241.	24618	*Oreoica gutturalis (Crested Bellbird)*			
242.	34012	*Oreoica gutturalis subsp. pallescens (Crested Bellbird, central)*			
243.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
244.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
245.		*Paracentropogon vespa*			
246.		*Paradiplogrammus enneactis*			
247.		*Paraplotosus albilabris*			
248.	25682	*Pardalotus striatus (Striated Pardalote)*			
249.		*Pelates quadrilineatus*			
250.		*Pelates sexlineatus*			
251.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
252.		*Pentasteron intermedium*			
253.	48060	*Petrochelidon ariel (Fairy Martin)*			
254.	48061	*Petrochelidon nigricans (Tree Martin)*			
255.	24659	*Petroica goodenovii (Red-capped Robin)*			
256.		*Petroscirtes breviceps*			
257.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
258.	25699	*Phalacrocorax varius (Pied Cormorant)*			
259.	24409	*Phaps chalcoptera (Common Bronzewing)*			
260.		*Phryganoporus tubicola*			Y
261.		*Platycephalus endrachtensis*			
262.		*Plectorhinchus multivittatus*			
263.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
264.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
265.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
266.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
267.	34013	*Pomatostomus superciliosus subsp. ashbyi (White-browed Babbler (western wheatbelt))*			
268.	24769	*Porzana fluminea (Australian Spotted Crake)*			
269.		*Psammoperca waigiensis*			
270.	25261	*Pseudechis australis (Mulga Snake)*			
271.		*Pseudolampona boree*			
272.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
273.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
274.	25264	*Pseudonaja nuchalis (Gwardar, Northern Brown Snake)*			
275.		*Pseudorhombus jenynsii*			
276.	24390	*Psophodes occidentalis (Western Wedgebill, Chiming Wedgebill)*			
277.		*Pteragogus enneacanthus*			
278.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
279.	25009	*Pygopus nigriceps*			
280.	24278	*Pyrrholaemus brunneus (Redthroat)*			
281.	48096	*Rhipidura albiscapa (Grey Fantail)*			
282.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
283.	24457	*Rhipidura phasiana (Mangrove Grey Fantail)*			
284.		*Scaevius milii*			
285.		*Scobinichthys granulatus*			
286.		*Scolopendra laeta*			
287.		*Scolopendra morsitans*			
288.		*Scolopsis sp.*			
289.		*Scorpaena sumptuosa*			
290.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
291.	24280	*Sericornis frontalis subsp. balstoni (White-browed Scrubwren)*			
292.		*Sillago analis*			
293.		*Sillago burrus*			
294.		*Sillago schomburgkii*			
295.		*Sillago vittata?*			
296.	25267	*Simoselaps littoralis (West Coast Banded Snake)*			
297.		*Siphamia cuneiceps*			
298.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
299.		*Spinasteron peron*			
300.		*Spinasteron westi*			
301.	48594	*Sternula nereis (Fairy Tern)*			
302.		*Stigmatopora nigra*			
303.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
304.	24936	*Strophurus michaelseni*			
305.	24946	*Strophurus strophurus*			
306.		*Suggrundus sp.*			
307.		*Synanceia horrida*			
308.		*Syngnathoides biaculeatus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
309.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
310.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
311.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
312.	30870	*Taeniopygia guttata (Zebra Finch)*			
313.	30871	*Taeniopygia guttata subsp. castanotis (Zebra Finch)*			
314.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
315.	25519	*Tiliqua rugosa*			
316.	25206	*Tiliqua rugosa subsp. palarra*			
317.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
318.		*Torquigener pleurogramma*			
319.		*Torquigener tuberculiferus*			
320.		*Torquigener whitleyi*			
321.		*Trichocyclus nigropunctatus*			
322.	30954	*Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)*			
323.	24069	*Tursiops truncatus (Bottlenose Dolphin)*			
324.		*Tylosurus gavialoides*			
325.		*Upeneus tragula*			
326.		*Urodacus hartmeyeri*			
327.		*Urodacus mckenziei*			
328.	24386	*Vanellus tricolor (Banded Lapwing)*			
329.	25211	*Varanus caudolineatus*			
330.	25212	*Varanus eremius (Pygmy Desert Monitor)*			
331.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
332.		*Wydundra kennedy*			
333.		*Yongeichthys nebulosus*			
334.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
335.	24857	*Zosterops luteus (Yellow White-eye)*			

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

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

APPENDIX B

Flora Species List

Family	Species
Aizoaceae	*Tetragonia sp.*
Amaranthaceae	?Ptilotus divaricatus
Apiaceae	*Daucus glochidiatus*
Apocynaceae	*Marsdenia graniticola*
Asparagaceae	*Acanthocarpus aff. rupestris*
Asparagaceae	*Thysanotus* ?patersonii
Asteraceae	*?*Urospermum picroides*
Asteraceae	*Gnephosis tenuissima*
Asteraceae	**Hypochaeris glabra*
Asteraceae	*Olearia ?occidentissima*
Asteraceae	*Pembertonia latisquamea*
Asteraceae	**Sonchus oleraceus*
Boraginaceae	*Halgania littoralis*
Brassicaceae	*?*Sisymbrium erysimoides*
Chenopodiaceae	*Atriplex paludosa*
Chenopodiaceae	*Enchylaena tomentosa*
Chenopodiaceae	*Maireana stipitata*
Chenopodiaceae	*Maireana trichoptera*
Chenopodiaceae	*Rhagodia latifolia*
Chenopodiaceae	*Salsola australis*
Chenopodiaceae	*Threlkeldia diffusa*
Colchicaceae	*Wurmbea inframediana*
Convolvulaceae	*Duperreya commixta*
Convolvulaceae	*Duperreya sericea*
Euphorbiaceae	*Euphorbia boophthona*
Fabaceae	*Acacia ligulata*
Fabaceae	*Acacia ramulosa var. ramulosa*
Fabaceae	*Acacia sclerosperma subsp. sclerosperma*
Fabaceae	*Acacia tetragonophylla*
Fabaceae	*Chorizema racemosum*
Fabaceae	*Indigofera georgei*
Fabaceae	*Senna glutinosa subsp. ×luerssenii*
Geraniaceae	?Erodium sp.
Goodeniaceae	*Goodenia berardiana*
Goodeniaceae	*Scaevola spinescens*
Hemerocallidaceae	*Dianella revoluta*
Juncaginaceae	*Triglochin calcitrapa*
Malvaceae	*Sida calyxhymenia*
Montiaceae	*Calandrinia* ?polyandra
Myrtaceae	*Melaleuca eulobata*
Myrtaceae	*Thryptomene dampieri*
Poaceae	?Eulalia aurea
Poaceae	*Austrostipa ?crinita*
Poaceae	*Austrostipa* sp.
Poaceae	*Triodia plurinervata*
Rhamnaceae	*Stenanthemum complicatum*
Santalaceae	*Exocarpos aphyllus*
Santalaceae	*Santalum spicatum*
Sapindaceae	*Alectryon oleifolius*
Sapindaceae	*Dodonaea inaequifolia*
Scrophulariaceae	*Eremophila glabra*
Scrophulariaceae	*Eremophila youngii subsp. youngii*
Solanaceae	**Lycium ferocissimum*
Solanaceae	*Solanum lasiophyllum*
Solanaceae	*Solanum oldfieldii*
Solanaceae	*Solanum orbiculatum subsp. orbiculatum*
Stylidiaceae	*Stylobasium spathulatum*
Thymelaeaceae	*Pimelea microcephala subsp. microcephala*
Zygophyllaceae	*Roepera fruticulosa*

APPENDIX C

Flora Site Sheet

FLORA SITE SHEET - WATER CORPORATION SITE

Project Name Denham Detailed Flora and Vegetation Survey
Site: WCQ01 **MGA** 49J 756042 **mE** 7131629 **mN**

Described by: CM, CK
Date: 2019-07-24
Type: Quadrat 30 x 30
Soil Colour: Brown,Orange
Soil Type: Sand
Habitat: Dune
Vegetation:

Mid Open Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over Low Open Shrubland *Chorizema racemosum* , *Melaleuca eulobata* and *Thryptomene dampieri* over Low Open Hummock Grassland of *Triodia plurinervata*

Veg Condition: Excellent
Fire Age: 1-5 years **Fire Evidence:** 1-5 years
Notes
Rock Type - **Rock Cover:** - % **Outcropping:** 0 %
Total PFC: 75 % **Bareground:** 20 % **Leaf Litter:** 5 % **Logs:** 0 %
Disturbance Type: -

SPECIES LIST

Name	Height	Cover	Notes
?Erodium sp.	5	0.1	
?Ptilotus divaricatus	20	0.1	
*?*Urospermum picroides*	5	0.1	
Acacia ligulata	120	3	
Acacia tetragonophylla	150	2	
Alectryon oleifolius	150	0	
Austrostipa ?crinita	50	0.1	
Chorizema racemosum	50	10	
Dianella revoluta	50	0.1	
Duperreya commixta	20	0.1	
Duperreya sericea	100	0.1	
Enchylaena tomentosa	30	0.1	
Eremophila glabra	30	0.1	
Euphorbia boophthona	50	0.1	
Exocarpos aphyllus	180	2	
Goodenia berardiana	5	3	
**Lycium ferocissimum*	20	0.1	
Maireana trichoptera	20	0.1	
Melaleuca eulobata	50	2	
Pembertonia latisquamea	20	0.1	
Pimelea microcephala subsp. microcephala	70	0.2	
Rhagodia latifolia	50	0.1	
Roepera fruticulosa	50	0.2	
Scaevola spinescens	120	0.5	
Solanum lasiophyllum	10	0.1	
Solanum orbiculatum subsp. orbiculatum	50	0.1	
Stenanthemum complicatum	30	1	
Stylobasium spathulatum	50	0.1	
Thryptomene dampieri	40	7	
Thysanotus ?patersonii	10	0.1	
Triodia plurinervata	20	15	P3

FLORA SITE SHEET - WATER CORPORATION SITE

Project Name Denham Detailed Flora and Vegetation Survey
Site: WCQ02 **MGA** 49J 755772 **mE** 7131619 **mN**

Described by: CM, CK
Date: 2019-07-25
Type: Quadrat 30 x 30
Soil Colour: Brown,Orange
Soil Type: Sand
Habitat: Dune
Vegetation:

Mid Open Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over Low Open Shrubland *Chorizema racemosum* , *Melaleuca eulobata* and *Thryptomene dampieri* over Low Open Hummock Grassland of *Triodia plurinervata*

Veg Condition: Excellent
Fire Age: 1-5 years **Fire Evidence:** 1-5 years
Notes
Rock Type - **Rock Cover:** - % **Outcropping:** 0 %
Total PFC: 50 % **Bareground:** 45 % **Leaf Litter:** 5 % **Logs:** 0 %
Disturbance Type: Rabbit tracks/scats

SPECIES LIST

Name	Height	Cover	Notes
?Erodium sp.	50	0.1	
?Eulalia aurea	30	0.1	
?Ptilotus divaricatus	30	0.1	
*?*Sisymbrium erysimoides*	30	0.1	
*?*Urospermum picroides*	50	0.1	
Acacia ligulata	120	15	
Acacia tetragonophylla	80	1	
Acanthocarpus aff. rupestris	30	0.1	P2
Calandrinia ?polyandra	3	0.1	
Chorizema racemosum	40	3	
Dianella revoluta	50	0.1	
Duperreya sericea	70	0.2	
Enchylaena tomentosa	10	0.1	
Eremophila youngii subsp. youngii	70	0.1	
Exocarpos aphyllus	150	1	
Goodenia berardiana	5	0.1	
**Lycium ferocissimum*	40	0.2	
Maireana trichoptera	20	0.1	
Marsdenia graniticola	50	0.1	
Melaleuca eulobata	50	2	
Olearia ?occidentissima	30	3	Potential P2
Pembertonia latisquamea	30	0.1	
Pimelea microcephala subsp. microcephala	70	0.1	
Rhagodia latifolia	40	0.1	
Roepera fruticulosa	40	0.1	
Santalum spicatum	120	0.5	
Scaevola spinescens	50	0.5	
Senna glutinosa subsp. ×luerssenii	20	0.1	
Solanum lasiophyllum	10	0.1	
Solanum oldfieldii	30	0.1	
Solanum orbiculatum subsp. orbiculatum	20	0.1	
Stenanthemum complicatum	40	0.1	
Stylobasium spathulatum	50	1	
Threlkeldia diffusa	20	0.1	
Thryptomene dampieri	40	7	
Thysanotus ?patersonii	20	0.1	
Triglochin calcitrapa	3	0.1	
Triodia plurinervata	30	1	P3
Wurmbea inframediana	50	0.1	
0			
0			
0			
0			
0			
0			
0			

FLORA SITE SHEET - WATER CORPORATION SITE

Project Name Denham Detailed Flora and Vegetation Survey
Site: WCQ03 **MGA** 49J 755667 **mE** 7131755 **mN**

Described by: CM, CK
Date: 2019-07-25
Type: Quadrat 30 x 30
Soil Colour: Brown,Orange
Soil Type: Sand
Habitat: Dune
Vegetation:

Mid Open Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over Low Open Shrubland *Chorizema racemosum* , *Melaleuca eulobata* and *Thryptomene dampieri* over Low Open Hummock Grassland of *Triodia plurinervata*

Veg Condition: Very Good
Fire Age: 1-5 years **Fire Evidence:** 1-5 years
Notes
Rock Type - **Rock Cover:** - % **Outcropping:** 0 %
Total PFC: 60 % **Bareground:** 38 % **Leaf Litter:** 2 % **Logs:** 0 %
Disturbance Type: Weeds

SPECIES LIST

Name	Height	Cover	Notes
?Erodium sp.	30	0.1	
?Ptilotus divaricatus	30	0.1	
*?*Sisymbrium erysimoides*	20	0.1	
*?*Urospermum picroides*	30	1	
Acacia ligulata	150	3	
Acacia tetragonophylla	50	1	
Acanthocarpus aff. rupestris	50	0.1	P2
Alectryon oleifolius	180	0.1	
Austrostipa ?crinita	20	0.1	
Calandrinia ?polyandra	3	0.1	
Chorizema racemosum	80	7	
Dianella revoluta	50	0.1	
Duperreya sericea	50	0.2	
Enchylaena tomentosa	20	0.1	
Euphorbia boophthona	10	0.1	
Exocarpos aphyllus	50	0.1	
Goodenia berardiana	50	0.1	
**Hypochaeris glabra*	5	0.1	
Indigofera georgei	10	0.1	
**Lycium ferocissimum*	50	0.1	
Maireana trichoptera	20	0.1	
Marsdenia graniticola	40	0.1	
Olearia ?occidentissima	30	0.1	Potential P2
Pembertonia latisquamea	30	0.1	
Rhagodia latifolia	70	0.1	
Roepera fruticulosa	30	1	
Scaevola spinescens	70	0.1	
Sida calyxhymenia	10	0.1	
Solanum lasiophyllum	10	0.1	
Solanum orbiculatum subsp. orbiculatum	50	0.1	
**Sonchus oleraceus*	5	0.1	
Stylobasium spathulatum	50	0.2	
Tetragonia sp.	3	0.1	
Threlkeldia diffusa	20	0.1	
Thysanotus ?patersonii	40	0.1	
Triglochin calcitrapa	3	0.1	
Triodia plurinervata	40	40	P3
0			
0			
0			
0			
0			
0			
0			
0			
0			

FLORA SITE SHEET - WATER CORPORATION SITE

Project Name Denham Detailed Flora and Vegetation Survey
Site: WCQ04 **MGA** 49J 755948 **mE** 7131690 **mN**

Described by: CM, CK
Date: 2019-07-26
Type: Quadrat 30 x 30
Soil Colour: Brown,Orange
Soil Type: Sand
Habitat: Dune
Vegetation:

Mid Open Shrubland of *Acacia ligulata* and *Exocarpos aphyllus* over Low Open Shrubland *Chorizema racemosum* , *Melaleuca eulobata* and *Thryptomene dampieri* over Low Open Hummock Grassland of *Triodia plurinervata*

Veg Condition: Excellent
Fire Age: 1-5 years **Fire Evidence:** 1-5 years
Notes
Rock Type - **Rock Cover:** - % **Outcropping:** 0 %
Total PFC: 60 % **Bareground:** 35 % **Leaf Litter:** 5 % **Logs:** 0 %
Disturbance Type: -

SPECIES LIST

Name	Height	Cover	Notes
?Eulalia aurea	30	0.1	
?Ptilotus divaricatus	20	0.1	
*?*Sisymbrium erysimoides*	20	0.1	
*?*Urospermum picroides*	30	0.1	
Acacia ligulata	120	7	
Acacia sclerosperma subsp. sclerosperma	120	0.1	
Acacia tetragonophylla	120	0.1	
Acanthocarpus aff. rupestris	20	0.1	P2
Atriplex paludosa	100	0.1	
Austrostipa sp.	20	0.1	
Chorizema racemosum	40	1	
Daucus glochidiatus	3	0.1	
Dianella revoluta	50	0.1	
Dodonaea inaequifolia	30	0.1	
Duperreya sericea	50	0.5	
Enchylaena tomentosa	20	0.1	
Euphorbia boophthona	20	0.1	
Exocarpos aphyllus	180	2	
Gnephosis tenuissima	3	0.1	
Goodenia berardiana	50	0.1	
**Lycium ferocissimum*	50	0.1	
Maireana stipitata	20	0.1	
Melaleuca eulobata	40	5	
Olearia ?occidentissima	30	0.1	Potential P2
Pembertonia latisquamea	50	0.1	
Pimelea microcephala subsp. microcephala	30	0.1	
Rhagodia latifolia	30	0.1	
Roepera fruticulosa	30	0.2	
Scaevola spinescens	50	1	
Senna glutinosa subsp. ×luerssenii	30	0.1	
Solanum lasiophyllum	10	0.1	
Solanum orbiculatum subsp. orbiculatum	40	0.1	
Stenanthemum complicatum	30	0.1	
Stylobasium spathulatum	40	0.1	
Thryptomene dampieri	50	5	
Thysanotus ?patersonii	30	0.1	
Triodia plurinervata	20	3	P3
Wurmbea inframediana	5	0.1	

FLORA SITE SHEET - WATER CORPORATION SITE

Project Name Denham Detailed Flora and Vegetation Survey
Site: WCR01 **MGA** 49J 755583 **mE** 7131425 **mN**

Described by: CM, CK
Date: 2019-07-26
Type: Releve 30 x 30
Soil Colour: Brown,Orange
Soil Type: Sand
Habitat: Dune
Vegetation:

Mid Sparse Shrubland of *Acacia ligulata* over Low Sparse Shrubland of *Chorizema racemosum* and *Stylobasium spathulatum* over Low Sparse Chenopod Shrubland of *Atriplex paludosa*

Veg Condition: Very Good
Fire Age: 1-5 years **Fire Evidence:** 1-5 years
Notes
Rock Type - **Rock Cover:** - % **Outcropping:** 0 %
Total PFC: 45 % **Bareground:** 50 % **Leaf Litter:** 5 % **Logs:** 0 %
Disturbance Type: -

SPECIES LIST

Name	Height	Cover	Notes
?Ptilotus divaricatus	30	0.1	
*?*Sisymbrium erysimoides*	20	0.1	
*?*Urospermum picroides*	3	0.1	
Acacia ligulata	120	7	
Atriplex paludosa	50	0.1	
Atriplex paludosa	50	2	
Chorizema racemosum	40	2	
Duperreya sericea	50	0.1	
Enchylaena tomentosa	10	0.1	
Exocarpos aphyllus	20	0.1	
Goodenia berardiana	10	0.1	
Halgania littoralis	10	0.1	
**Hypochaeris glabra*	3	0.1	
Lycium ferocissimum	50	0.1	
Pembertonia latisquamea	30	0.1	
Rhagodia latifolia	50	0.1	
Roepera fruticulosa	50	0.1	
Salsola australis	10	0.1	
Solanum lasiophyllum	20	0.1	
Solanum orbiculatum subsp. orbiculatum	50	0.1	
Stylobasium spathulatum	70	1	
Thryptomene dampieri	40	0.1	

APPENDIX D

Fauna Habitat Assessments

Fauna Habitat Assessment - Acacia Shrubland, over triodia - WC1

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.910487 **Longitude:** 113.552341

Vegetation

Vegetation Description: Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca

Botanical Province: Eremaean and Northern

Vegetation Condition: Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.5	10	Sparse
Midstorey	*Acacia, Thryptomene and Melaleuca over Triodia*	0.3	50	Moderate
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	500m-2km

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	10-20%	Hummock Grass	50-90%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	2-10%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	2-10%	Other:	0

Microhabitats

Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland - WC2

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.910556 **Longitude:** 113.553519

Vegetation

Vegetation Description: Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca

Botanical Province: Eremaean and Northern

Vegetation Condition: Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.2	40	Moderate
Midstorey	*Acacia, Thryptomene and Melaleuca*	0.3	30	Moderate
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	500m-2km

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	20-50%	Hummock Grass	<2%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	2-10%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	0%	Other:	0

Microhabitats

Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland, over triodia - WC3

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.911062 **Longitude:** 113.555992

Vegetation

Vegetation Description:	Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca	Botanical Province:	Eremaean and Northern
		Vegetation Condition:	Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.4	30	Moderate
Midstorey	*Acacia, Thryptomene and Melaleuca over Triodia*	0.3	40	Moderate
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	500m-2km

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	20-50%	Hummock Grass	20-50%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	<2%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	2-10%	Other:	0

Microhabitats

				Disturbance			
Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland - WC4

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.911369 **Longitude:** 113.553689

Vegetation

Vegetation Description:	Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca	Botanical Province:	Eremaean and Northern
		Vegetation Condition:	Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.2	40	Moderate
Midstorey	*Acacia, Thryptomene and Melaleuca*	0.3	5	Sparse
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	<500m

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	50-90%	Hummock Grass	<2%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	2-10%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	2-10%	Other:	0

Microhabitats

				Disturbance			
Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland - WC5

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.911605 **Longitude:** 113.556536

Vegetation

Vegetation Description: Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca

Botanical Province: Eremaean and Northern

Vegetation Condition: Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.6	30	Moderate
Midstorey	*Acacia, Thryptomene and Melaleuca*	0.3	15	Sparse
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	<500m

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	20-50%	Hummock Grass	<2%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	2-10%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	<2%	Other:	0

Microhabitats

Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland, over triodia -WC6

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.912029 **Longitude:** 113.555904

Vegetation

Vegetation Description: Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca

Botanical Province: Eremaean and Northern

Vegetation Condition: Excellent

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.4	20	Moderate
Midstorey	*Acacia, Thryptomene and Melaleuca over Triodia*	0.3	60	Dense
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	<500m

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	10-20%	Hummock Grass	50-90%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	10-20%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	<2%	Other:	0

Microhabitats

Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

Fauna Habitat Assessment - Acacia Shrubland (Degraded) - WC7

Project: 3242 Denham Flora & Fauna Survey **Date:** 2019-07-25 **Quadrat Size:** 50x50 **Latitude:** -25.914380 **Longitude:** 113.549940

Vegetation

Vegetation Description: Open Acacia and Exocarpos Shrubland, over Acacia, Thryptomene, Chorizema, Melaleuca

Botanical Province: Eremaean and Northern

Vegetation Condition: Degraded

Stratum	Vegetation Species	Height (m)	% Cover	Description
Overstorey	*Acacia*	1.2	20	Moderate
Midstorey	*Mixed low shrubs*	0.2	5	Sparse
Understorey	*Annual Herbs*	0.1	2	Sparse

Soil

Soil Texture	Sand	Soil Colour	Light orange

Water

Water Prescence	None	Water Distance	<500m

Ground Cover

Pebbles (<0.6cm)	0%	Rocks (20-60cm)	0%	Bare Ground	50-90%	Hummock Grass	<2%
Small Stones (0.6-2cm)	0%	Big Rocks (60cm-2m)	0%	Leaf Litter	<2%	Tussock Grass	<2%
Stones (2-6cm)	0%	Boulders (>2m)	0%	Logs >10cm	0%	Herbs	<2%
Small Rocks (6-20cm)	0%	Outcrop	0%	Woody Debris	<2%	Other:	0

Microhabitats

Exfoliating Slabs	None	Caves	None	Last Fire	>5 years	Fire Intensity	Unknown
Rock Crevices	None	Tree Hollows	None	Cattle Disturbance	None	Other Disturbance	Goat and Rabbit
Peeling Bark	Rare	Termite Mounds	Rare				

APPENDIX E

Flora Statistics

```
# Compare species richness between sites

# Set the working directory to the folder containing the code and array
file
library(rstudioapi)
wd <- setwd(dirname(rstudioapi::getActiveDocumentContext()$path))
wd

library(vegan)
library(dplyr)

#  Import the array csv dataset, then make Site number into a row name
all_sites<-read.csv('array.csv', header = T, sep=",")
AllSites_community = all_sites[3:83]

curve_all <- specaccum(AllSites_community, method = "random",
                       permutations = 100)
plot(curve_all, xlab = "Sites", ylab = "Species", lwd=1, col="black")



S#subset each habitat into its own df
all_sites %>% filter(Site == "Synergy") -> Synergy
all_sites %>% filter(Site == "Water_Corporation") -> Water_Corporation
all_sites %>% filter(Site == "Shire") -> Shire


#calc species accumulation curve for each habitat
curve_Synergy = specaccum(Synergy[, 3:83], method = "random")
curve_WC = specaccum(Water_Corporation[, 3:83], method = "random")
curve_shire = specaccum(Shire[, 3:83], method = "random")

#then plot the rest
plot(curve_Synergy, xlab = "Sites", ylab = "Species", lwd=1, col="blue")
plot(curve_WC, xlab = "Sites", ylab = "Species", lwd=1, col=3)
plot(curve_shire, xlab = "Sites", ylab = "Species", lwd=1, col=2)

#then plot them together rest

plot(curve_all, xlab = "Sites", ylab = "Species", lwd=1, col="black")
plot(curve_Synergy, add = TRUE, col = 2) #col is COLOUR setting, so
change it to something else if you want
plot(curve_WC, add = TRUE, col = 3)
plot(curve_shire, add = TRUE, col = 4)
```

```
# Compare species richness between sites

# Set the working directory to the folder containing the code and array
file
library(rstudioapi)
wd <- setwd(dirname(rstudioapi::getActiveDocumentContext()$path))
wd

#  Import the array csv dataset, then make Site number into a row name
array<-read.csv('array.csv', header = T, sep=",")
library(textshape)
array1<-column_to_rownames(array,'Site_Num')

# Split the array into species counts and environmental factors using c
to select columns and -c to drop columns
species<-subset(array1, select = -c(Site))

env<-subset(array, select = c(Site_Num,Site))


# Calculate the number of sites using nrow
nrow(env)

# Calculate the number of species
ncol(species)

# Calculate  species richness per site and treatment
library(vegan)
env$Richness<-specnumber(species)

# Calculate  mean/se species richness per site and treatment
library(Rmisc)
mean_rich_status<-summarySE(data = env, measurevar="Richness",
groupvars="Site")

# Plot richness per site then produce and export bar plot
library(ggplot2)
mean_rich_plot<-ggplot(mean_rich_status, aes(x=Site, y=Richness,
fill=Site)) +
  geom_bar(stat="identity") +
  geom_errorbar(aes(ymin=Richness-se, ymax=Richness+se),
                width=.2)+
  theme(axis.title.x=element_blank(), legend.position = "none")
mean_rich_plot
ggsave("mean_richness.png", height=10, width=15, units='cm', dpi=1000)
ggsave("mean_richness.svg", height=10, width=15, units='cm', dpi=1000)


# Compare species richness between treatments via boxplot
rich_boxplot<-ggplot(env, aes(x = Site, y = Richness, fill = Site))+
  geom_boxplot()+
  theme(axis.title.x=element_blank(), legend.position = "none")
rich_boxplot
ggsave("boxplot_richness.png", height=10, width=15, units='cm', dpi=1000)
ggsave("boxplot_richness.svg", height=10, width=15, units='cm', dpi=1000)
```

```
# Plot some rough species accumulation curve with 95% confidence
intervals across all sites to make an assessment of the data - exact
(sobs), random and rearefaction curves
# From the packages BiodiversityR and vegan
plot(specaccum(species,"exact"), xlab = "Sites", ylab = "Species", lwd=1,
col="blue")
plot(specaccum(species,"random"), xlab = "Sites", ylab = "Species",
lwd=1, col="red")
plot(specaccum(species,"rarefaction"), xlab = "Individuals", ylab =
"Species")


# Estimators for all sites combined
sp1_pool <- poolaccum(species, permutations = 1000)
summary(sp1_pool, display = c("chao"))
png('all_Site_curve.png')
plot(sp1_pool)
dev.off()

# Estimate of number of species by Site
data(species)
data(env)
attach(env)
pool <- specpool(species, Site)
print(sp1_pool)


# Examine species extrapolation curves using iNEXT package
library(iNEXT)

richness_site<-with(env, split(Richness,Site))
str(richness_site)

# Sample-size-based R/E curves, separating by "site"
# Hill numbers of order q: species richness (q = 0), Shannon diversity (q
= 1, the exponential of Shannon entropy) and Simpson diversity (q = 2,
the inverse of Simpson concentration).
# out <- iNEXT(treat_matrix, q=c(0, 1, 2), datatype="abundance",
endpoint=200)

out <- iNEXT(richness_site, q=0, datatype="abundance", endpoint=30)
out

# Sample-size-based R/E curve type 1
ggiNEXT(out, type=1, se=TRUE)+
   labs(x="Number of Individuals", y="Species Richness")
ggsave("sac_site.png", height=10, width=15, units='cm', dpi=1000)
ggsave("sac_site.svg", height=10, width=15, units='cm', dpi=1000)


# Sample completeness curve type 2
ggiNEXT(out, type=2, facet.var="none", se=TRUE)+
  labs(x="Number of Individuals", y="Sample Coverage")
ggsave("sac_completeness.png", height=10, width=15, units='cm', dpi=1000)
ggsave("sac_completeness.svg", height=10, width=15, units='cm', dpi=1000)


# Curve for the number of sampling units (sites)
```

```
# Claculate the curve - click on the plot to place the legend
library(vegan)
library(BiodiversityR)

c1<-accumcomp(species, y=env, factor='Site', method='rarefaction',
xlab='Sites', ylab='Species Richness')
c1

# Get the data into a data frame and spread the data into a wide format
df0 <- as.data.frame.table(c1)
head(df0)
library(tidyr)
df <- spread(data = df0, key = Var3, value = Freq)
head(df)

# Calculate upper and lower sd and add to the data frame
df$up_sd<-df$Richness+df$sd
df$low_sd<-df$Richness-df$sd

# Plot onto a prettier plot using ggplot and export
raref_plot<-ggplot(df, aes(x=Sites, y=Richness, colour=Site))+
  geom_line(aes(data=Richness), size=2)+
  geom_ribbon(aes(ymin=low_sd, ymax=up_sd,
                  fill=Site, colour=NULL), alpha=0.2)
raref_plot
ggsave("rarefaction.png", height=10, width=15, units='cm', dpi=1000)
ggsave("rarefaction.svg", height=10, width=15, units='cm', dpi=1000)


# Calculate dissimilarity and plot divisive clustering:
library(cluster)
distmatrix <- vegdist(species, "bray")
cluster1 <- diana(distmatrix)
summary(cluster1)

plot(cluster1, which.plots=2, hang=-1,  xlab="Site Number", sub="",
main="")
# grid(col="lightgrey", lty=1)
rect.hclust(cluster1, k=5, border="red")
k=5
abline(h = 0.32, lwd = 2, lty = 2, col = 'blue')
ggsave("dendro.png", height=10, width=15, units='cm', dpi=600)
ggsave("dendro.svg", height=10, width=15, units='cm', dpi=600)



# Synergy daya
Synergy_data <- array[ which(Site=='Synergy'),]

# Split the array into species counts and environmental factors using c
to select columns and -c to drop columns
Sd1<-subset(Synergy_data, select = -c(Site))
sd2<-column_to_rownames(Sd1,'Site_Num')

library(cluster)
distmatrix <- vegdist(sd2, "bray")
cluster1 <- diana(distmatrix)
summary(cluster1)
```

```
png('synergy_cluster.png')
windows(10,10)
plot(cluster1, which.plots=2, hang=-1,  xlab="Site", sub="", main="")
dev.off()

synergy_curves <- poolaccum(sd2, permutations = 100)
summary(synergy_curves, display = c("chao"))

png('synergy_curves.png')
plot(synergy_curves)


# WC
WC_data <- array[ which(Site=='Water_Corporation'),]

# Split the array into species counts and environmental factors using c
to select columns and -c to drop columns
wc1<-subset(WC_data, select = -c(Site))
wc2<-column_to_rownames(wc1,'Site_Num')

library(cluster)
distmatrix <- vegdist(wc2, "bray")
cluster2 <- diana(distmatrix)
summary(cluster2)

png('wc_cluster.png')
plot(cluster2, which.plots=2, hang=-1,  xlab="Site", sub="", main="")
dev.off()

wc_curves <- poolaccum(wc2, permutations = 100)
summary(synergy_curves, display = c("chao"))

png('wc_curves.png')
plot(wc_curves)


# Shire Cluster
Shire_data <- array[ which(Site=='Shire'),]

# Split the array into species counts and environmental factors using c
to select columns and -c to drop columns
Shire1<-subset(Shire_data, select = -c(Site))
Shire2<-column_to_rownames(Shire1,'Site_Num')

library(cluster)
distmatrix <- vegdist(Shire2, "bray")
cluster3 <- diana(distmatrix)
summary(cluster3)


windows(10,10)
plot(cluster3, which.plots=2, hang=-1,  xlab="Site", sub="", main="")
png('shire_cluster.png')
dev.off()

shire_curves <- poolaccum(Shire2, permutations = 100)
summary(shire_curves, display = c("chao"))
```

```
png('shire_curves.png')
windows(10,10)
plot(shire_curves)
```

360 environmental

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