360 environmental

Australian Bundle Site

Detailed Flora and Vegetation Assessment

Prepared for:
Subsea7

October 2017

people planet professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
2198AB	A INTERNAL DRAFT	AD	NW/FJ	1 Electronic (email)	30/06/17
2198AB	B CLIENT DRAFT	AD		1 Electronic (email)	10/07/17
2198AB	C CLIENT DRAFT	SF	SS/FJ	1 Electronic (email)	12/10/17
2198AB	D CLIENT FINAL			1 Electronic (email)	17/10/17

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Executive Summary

360 Environmental Pty Ltd (360 Environmental) was commissioned by Subsea7 in May 2017 to undertake a Detailed Flora and Vegetation Assessment for a site along the coastline of northwest Australia located in Learmonth as a potential site for the fabrication and launch of bundles. The purpose of the assessment was to help determine the environmental values within and in proximity to the proposed development envelope. The Survey Area is 534 ha and is located approximately 35 kilometres south of the Exmouth town site, in the Carnarvon biogeographic region of Western Australia.

A total of 74 taxa (including species, subspecies, varieties and forms) from 56 genera and 25 families were identified in the Survey Area. Three introduced species were recorded within the Survey Area, none of which are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weeds of National Significance (WONS).

Review of the database searches identified 26 conservation significant flora taxa potentially occurring in the vicinity of the Survey Area. Of these, none are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Wildlife Conservation Act 1950* (WC Act). All 26 are Department of Biodiversity Conservation and Attractions (DBCA) Priority listed taxa. The potential occurrence in the Survey Area of two of these taxa is considered Possible, two are considered as Unknown due to a lack of available information and 22 as Unlikely. It is considered likely that these species, if present, would have been identified during the survey.

One species *Corchorus congener* a Priority 3 listed species was recorded in multiple sites across the Survey Area, and is considered likely to occur commonly outside of the Survey Area. No Threatened flora species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey.

Ten natural vegetation units, one Completely Degraded unit and one 'Beach' unit were described for the Survey Area. The vegetation condition ranged from Very Good to Completely Degraded.

A search of the DPaW database and EPBC Protected Matters Search Tool (EPBC PMST) for Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) did not identify any TECs or PECs as occurring within the proximity of the Survey Area. None of the vegetation units identified in the Survey Area are considered likely to represent any TECs or PECs.

A portion of the northern section of the Survey Area is mapped as an Environmentally Sensitive Area (ESA). It is likely that this ESA is not in relation to the flora and vegetation values in the Survey Area and more so due to the underground Cape Range Subterranean Waterways system identified in the *Directory of Important Wetlands in Australia.* This conclusion is drawn based on the majority of the area that is mapped as the ESA having been historically cleared with a well-used existing track running through this section of the Survey Area, along with the dominance of weeds and sheep grazing.

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1 Introduction

1.1 The Project

Subsea7 has identified a site along the coastline of northwest Australia located in Learmonth as a potential location for the fabrication and launch of bundles. 360 Environmental Pty Ltd was commissioned by Subsea7 in May 2017 to undertake a Detailed Flora and Vegetation Assessment for this proposed bundle site, and again in September 2017 to survey an extended area (referred to together as the Survey Area [Figure 1]).

The purpose of the survey was to help determine the environmental values within and in proximity to the proposed development envelope.

1.1.1 Location

The Survey Area is 534 ha and is located approximately 35 kilometres (km) south of the Exmouth town site, in the Carnarvon biogeographic region of Western Australia (WA).

1.1.2 Objectives

The objectives of the flora and vegetation assessment were to:

- Conduct a desktop assessment of relevant literature, databases and spatial datasets to determine the environmental values and any potential issues, such as Threatened/Rare and significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the Survey Area and the surrounding areas;
- Undertake a field survey including the use of quadrats along with targeted searches for species of conservation significance where required to verify the accuracy of the desktop assessment;
- Delineate and characterise the flora and the range of vegetation units present in the Survey Area; and
- Assess and map the vegetation condition in the Survey Area.

Legend

- Survey Area
- Learmonth RAAF Base
- Roads

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED FROM LANDGATE
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Sep 2013
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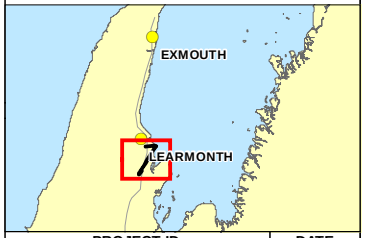
Meters

1:70,000 @ A3

LOCALITY MAP



PROJECT ID	DATE
2061	2/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 1
Site Location

K:\Projects\1.0 EBS\2198 Subsea 7 Eco Surveys\Figures\2198 Figure 1 Site Location.mxd

1.2 Background to the Protection of Flora and Vegetation

WA's flora is protected formally and informally by various legislative and non-legislative measures, which are as follows:

- Legislative measures:
  - Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
  - WA *Biodiversity Conservation Act 2016* (BC Act);
  - WA Environmental Protection Act 1986 (EP Act); and
  - WA Biosecurity and Agriculture Management Act 2007 (BAM Act).
- Non-legislative measures:
  - WA Department Biodiversity Conservation and Attractions (DBCA) Priority lists for flora, ecological communities;
  - Weeds of National Significance (WONS); and
  - Recognition of locally significant populations by DBCA.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A. Conservation categories for ecological communities are provided in Appendix B.

1.2.1 EPBC Act

The EPBC Act aims to protect Matters of National Environmental Significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment and Energy (DEE) lists threatened species and communities in categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html) (Appendices A and B).

Projects likely to cause a significant impact on MNES should be referred to the DEE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DBCA lists flora under the provisions of the WC Act as protected according to their need for protection (Appendix A).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) are protected throughout the State.

1.2.3 EP Act

Threatened flora and TECs are given special consideration in environmental impact assessments, and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in an ESA.

1.2.4 BAM Act

Pests may be 'Declared' by the Minister for Agriculture under the BAM Act. The Western Australian Organism List (WAOL) contains information on the area(s) in which a plant is declared and the control and keeping categories to which it has been assigned in Western Australia. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food Western Australia [DAFWA] 2015).

1.2.5 Weeds of National Significance

The Australian Government along with the State and Territory governments has endorsed 32 WONS. Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (Thorp & Lynch 2000).

1.2.6 DBCA Priority Lists

The DBCA lists 'Priority' flora that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act. Flora assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora require monitoring every 5-10 years and Priority 5 flora are subject to a specific conservation programme (Appendix A).

The DBCA maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Appendix B).

1.2.7 Informal Recognition of Flora

Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, changed fire regimes), and relict populations of such species assume local importance for the DBCA. It is not uncommon for the DBCA to make comment on these species of interest.

2 Biophysical Environment

2.1 Climate

The closest long term official Bureau of Meteorology (BoM) weather station currently operating near to the Survey Area is at Learmonth Airport (Station number 5007), approximately 2.5 km to the north of the Survey Area.

Learmonth Airport recorded 269.30 mm of rain in the 12 months prior to the initial survey (May 2016 – April 2017). This is 43.7 mm above the long term average rainfall of 260.7 mm for the same period (BoM 2017). For the three months prior to the survey (February 2017 - April 2017), Learmonth recorded 62 mm of rainfall, 38.2% (38.3 mm) below the 100.3 mm long term average rainfall for the same period. In the three months preceding the additional survey (June - August 2017), Learmonth recorded 11.7mm of rainfall, 84.69% (64.7mm) below the 76.4mm long term average rainfall to the same period (Figure 2) (BoM 2017).

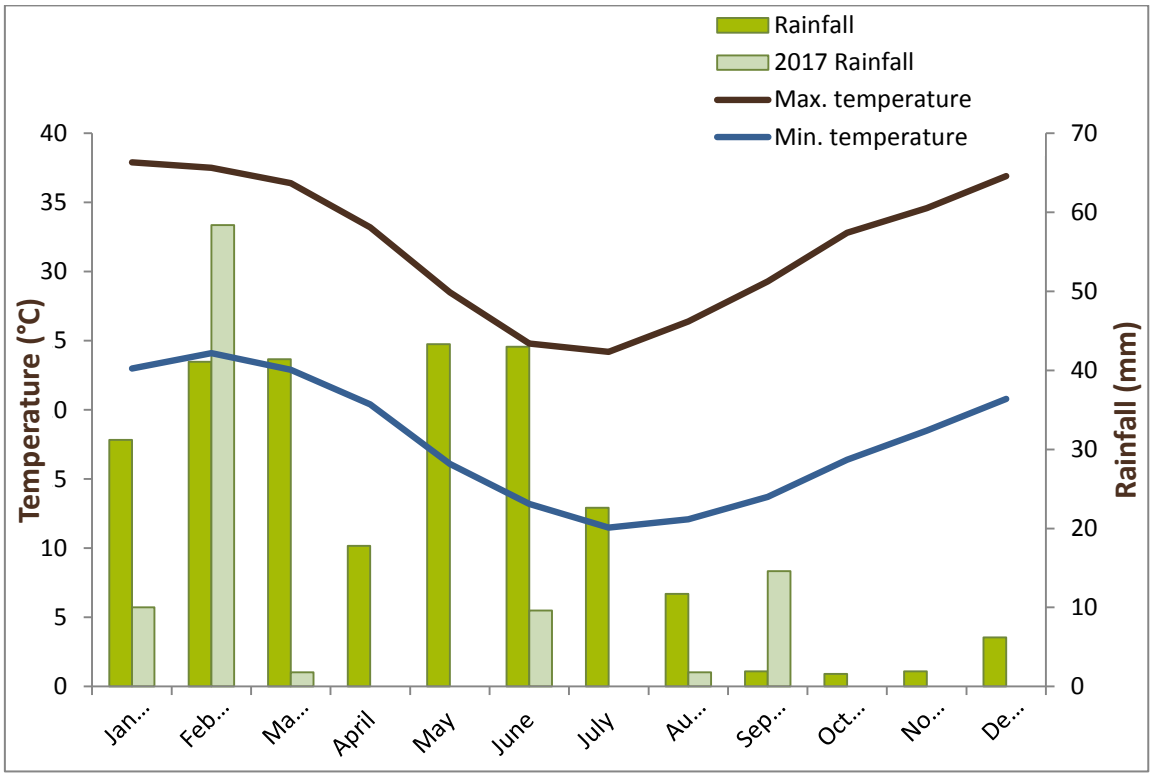


Figure 2: Mean Rainfall (from 1975 to 2017) for Learmonth (5007) (BoM 2017).

2.2 Biogeographic Regionalisation for Australia

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA

framework. The Survey Area lies within the Carnarvon Bioregion and Cape Range subregion (Figure 3).

The Carnarvon bioregion is composed of quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrub on clay flats and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with *Acacia stuartii* or *A. bivenosa* shrubland outcrop in the north, where extensive tidal flats in sheltered embayments support Mangal (Kendrick & Mau 2002).

2.1 Geology and Soils

Soil-landscape mapping of south WA has been captured at scales ranging from 1:20,000 to 1:250,000 (DAFWA 2012). Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales. The Survey Area contains the following soil system units:

- Colluvium 38491: Colluvium and/or residual deposits, talus, scree, sheet wash; boulder, gravel, sand; may include minor alluvial or sand plain deposits;
- Dunes 38496: Dunes, sand plain with dunes and swales; may include numerous interdune claypans; residual and aeolian sand with minor silt and clay; aeolian red quartz sand, clay and silt, in places gypsiferous; yellow hummocky sand; and
- Estuarine and delta deposits 38489: Coastal silt and evaporate deposits; estuarine, lagoonal and lacustrine deposits.

2.2 Land System Mapping

The Department of Agriculture and Department of Lands undertook a regional survey of approximately 74,500 km^2 pastoral lands in the Carnarvon Basin extending from Exmouth Gulf in the north to Nerren Nerren station south of Shark Bay and inland to Carey Downs Station in the east (Payne *et al.* 1987).

The purpose of this was to provide a comprehensive description and mapping of the pastoral resources of the region, together with an evaluation of pastoral potential and the condition of the soils and vegetation throughout. From that survey a total 89 land systems were mapped for the region.

The current Survey Area contains two mapped land systems which are listed and described in Table 1 and displayed in Figure 4.

Table 1: Land Systems in the Survey Area

LAND SYSTEM	DESCRIPTION	EXTENT IN THE REGION (HA)
Cardabia System	Undulating sandy plains with linear dunes, minor limestone plains and low rises, supporting mainly soft spinifex hummock grasslands with scattered acacias and other shrubs.	435.10
Littoral System	Bare coastal mudflats (unvegetated), samphire flats, sand islands, coastal dunes and beaches, supporting samphire low shrublands, sparse *Acacia* shrublands and mangrove forests.	73.99

2.3 Broad Vegetation Types

Mapping of the vegetation of the Pilbara region which included the Survey Area was completed on a broad scale (1:1,000,000) by Beard (1975). These vegetation units were later re-assessed by Shepherd *et al.* (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

The Shepherd *et al.* (2001) vegetation type in the Survey Area (along with the corresponding Beard [1975] type, in brackets), is described below:

- **117 (Coastal Dunes) (a3Srt1hi)** – Hummock grasslands, grass steppe; soft spinifex; and
- **662 (Coastal Dunes) (anSZrt1,2Hi)** – Hummock grassland; shrub steppe; mixed *Acacia* scrub and dwarf scrub with soft spinifex and *Triodia basedowii*.

2.4 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. There is a mapped ESA in the northern section of the Survey Area (Figure 5). It is likely that the ESA is related to the underground aquifer system, Cape Range Subterranean Waterways which has been identified in the *Directory of Important Wetlands in Australia* (DPaW[1] 2010) and is not directly related to the values of the flora and vegetation in the Survey Area.

[1] Department of Parks and Wildlife, now the Department of Biodiversity Conservation and Attractions (DBCA)

3 Methods

3.1 Background

The flora survey was consistent with a Detailed Flora and Vegetation Survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in WA where practical and relevant, as set out in the following documents:

- EPA Environmental Factor Guideline: Flora and Vegetation (EPA 2016a)); and
- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DBCA Threatened and Priority Flora database (DPaW 2017a);
- DBCA Threatened and Priority Ecological Communities database (DPaW 2017b);
- NatureMap (DPaW 2017c);
- DEE Protected Matters Search Tool (DEE 2017); and
- Relevant botanical surveys (see section 4.2.2).

A request for a database search was submitted to the DPaW on the 10 May 2017 (10 km radial search) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area. These sources were used to compile a list of expected Threatened or Priority species and TECs and PECs hat may occur based on the landforms in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The initial field survey was conducted from the 22 - 26 May 2017 by two botanists, , and a follow up survey of the extended Survey Area was conducted in September . The survey included the installation of 29 quadrats (22 during the initial survey, and seven during the additional survey), and vegetation habitat and condition mapping. Quadrats are vegetation survey plots which were accurately measured out with each corner demarcated with a steel stake; the northwest (NW) corner is marked with a permanent marker and flagging tape. Quadrats were measured at 20 m x 20 m to cover a surface area of 400 m^2. This was altered to 10 m x 40 m in some areas where the vegetation type was a thinner more linear shape, such as the top of the sand dunes, making 20 m x

20 m not possible. The GPS locations of the NW corners of each plot were recorded using a handheld Garmin GPS unit, and a photo was taken. The quadrat locations are presented in Figure 6.

In addition to the data collected from quadrats, traverses throughout the Survey Area were undertaken for vegetation mapping purposes and significant flora searches, including but not limited to Threatened flora, Priority flora and introduced flora (in particular declared taxa).

Permits

This flora survey was conducted under the following licence SL011882 issued Amy Dalton and licence SL011217 issues to Sophie Fox to take flora for scientific or other prescribed purposes issued by DPaW.

3.2.3 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the WA Herbarium (WAH).

The species list was checked against FloraBase (WAH 2017 to determine the species name status, naturalised status and conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine Commonwealth listing.

The WAOL list was consulted to determine if any are Declared Plants, and the Weeds of National Significance list to determine any WONS (Thorp & Lynch 2000).

3.2.4 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by the quadrat data and field observations. Vegetation types and vegetation condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:3,000 scale), which were digitised in the office using GIS software (ArcGIS 9.3.1). Vegetation condition was assessed based on the Trudgen vegetation condition scale (Trudgen 1998) (Appendix D).

4 Results

4.1 Flora and Vegetation Assessment Limitations and Constraints

Survey constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey limitations and constraints of the flora and vegetation assessment are detailed in Table 2.

Table 2: Limitations and constraints associated with the Survey Area.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	During the initial survey, the entire Survey Area was accessed; with most areas being easily accessible via vehicle and on foot. Particular focus was given to areas expected to be impacted and areas that may have species of conservation significance. Due to the linear nature of the Survey Area, during the additional survey some parts of the central Survey Area were difficult to access due to the lack of vehicle tracks. The majority of these areas were accessed on foot, with small portions having to be extrapolated using the high resolution aerial imagery and mapping notes from the initial survey.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: • Field Staff: Sophie Fox (Botanist) and Amy Dalton (Botanist); Steve Cossington (Ecologist) • Taxonomy: Kathya Tippur (Taxonomist), Sophie Fox; Data Interpretation and Reporting : Amy Dalton and Sophie Fox; and • Report Review: Narelle Whittington (Principal Botanist) and Felicity Jones (Principal Environmental Consultant/ Group Leader).
Timing, weather, season	Flora composition changes with time, particularly seasonally as a result of changes in conditions such as rainfall. Therefore, botanical surveys completed at different times of the year will often produce varying results. The initial survey was conducted during the beginning of May which is during the recommended flora survey period

VARIABLE	IMPACT ON SURVEY OUTCOMES
	for the Eremaean Province. The additional survey was conducted in September. For the three months preceding both the initial and additional survey, below average rainfall was recorded (refer to section 2.1). However this was not considered to be a limitation, despite the below average rainfall a high number of flowering species were present in both surveys, including some annual species.
Scope: Life forms sampled	The scope of this project included surveying of flora and vegetation and searching for conservation significant species or communities likely to be present (based on habitat in the Survey Area and database search results).
Sources of information	Relevant DPaW and DEE searches were undertaken for the Survey Area and are listed in section 3.2.1. Few biological surveys have been undertaken in the area and as such there is a lack of publicly available reports.
Completeness	The entire Survey Area was accessible during the initial survey, due to some established fence line tracks and some light vehicle tracks allowing for access to some of the central areas of the Survey Area. The time spent conducting the initial survey was considered adequate for the size, complexity of the site and the survey. During the additional survey, the light vehicle tracks were no longer present or could not be located, which therefore caused a restriction in available access to the central part of the Survey Area. Where possible, this area was traversed by foot, however in some cases the vegetation types were extrapolated using data from the initial survey, and high definition aerial imagery. It is not considered to be a constraint to the reliability of the survey findings. All vegetation units were sufficiently surveyed; with 22 quadrats established in the initial survey and 7 quadrats established in the additional survey, and vegetation mapping conducted during both surveys.

4.2 Desktop Flora and Vegetation Results

4.2.1 Database Searches

The review of the database searches identified 26 conservation significant flora taxa potentially occurring in the vicinity of the Survey Area (Figure 7 and Appendix E). All 26 taxa are DBCA Priority listed taxa and none are listed under the EPBC Act or WC Act.

Of the 26 conservation significant flora taxa considered to potentially occur in the Survey Area, two are considered Possible and 22 as Unlikely, with one species *Corchorus congena* (Priority 3) was recorded during the survey. The likelihood of two species is considered Unknown due to a lack of available information of their closest records. The likelihood assessment of these 26 conservation significant species occurring in the Survey Area is shown in Appendix F.

A search of the DPaW database and EPBC PMST for TECs and PECs did not identify any State or Federally listed TECs or PECs as occurring in close proximity to the Survey Area.

4.2.2 Previous Biological Surveys

The vascular flora of the Cape Range peninsula has not been extensively surveyed and its relationship with the flora of other similar areas is poorly known (Keighery & Gibson 1993). A survey of the limestone hills, ranges and calcarenite outcrops extending north from Lake MacLeod to Vlaming head was undertaken by Keighery & Gibson (1993). A total of 209 taxa were recorded from 30 quadrats (each 100 m^2) during the survey with the species richness ranging from 12 to 44 species per quadrat. The quadrats were classified into five distinctive community types comprising two southern groups, two northern groups and a single quadrat representing Quaternary red sands over limestone. The vegetation community types described by Keighery & Gibson (1993) are outlined below:

- Community type 1 consisted of low heaths dominated by *Grevillea variifolia*, *Melaleuca cardiophylla* or *Acacia tetragonophylla* over a *Triodia* sp. This community occurs on the low ridges of Bundera calcarenite in the Coral Bay area and is species rich. Species such as *Acanthocarpus humilis*, *Themeda triandrus* and *Thryptomene baeckeacea* are largely restricted to it (Keighery and Gibson 1993);
- Community type 2, the single quadrat located in red Quaternary sands over limestone was very different from all the other quadrats. It is a shrubland dominated by *Banksia ashbyii*, *Hibbertia spicata* and *Hakea stenophylla*. Six out of the 16 species at this site were unique to this community (Keighery and Gibson 1993);
- Community type 3 was restricted to the tertiary limestones of the Gnargoo and Giralia Ranges. These quadrats were dominated by either *Acacia startii*, *A. victoriae* or *A. tetragonophylla* or combinations of these species. Grass species were variable but they have a rich herb layer which generally included such species as *Helichrysum ayersii*, *Ptilotus helichrysoides* and *Angianthus milnei* (Keighery and Gibson 1993);

- Community type 4 occurred on the massive tertiary limestones of the Cape Range itself. This community consisted of shrublands dominated by *Acacia tetragonophylla*, *A. bivenosa*, *Grevillea variifolia subsp. variijolia*, *G. calcicola*, *Melaleuca cardiophylla* or on the terraces north of Yardie Creek by *Ipomoea yardiensis*. *Triodia wiseana* or *T. pungens* were the obvious hummock grasses. A whole series of less common herbs and shrubs are restricted to this community; these included *Ipomoea costata*, *Acacia arida*, *Centaurium spicatum* and *Portulaca conspicua* (Keighery and Gibson 1993); and
- Community type 5 includes the younger limestones of the western coastal plain and the Rough Range which is generally dominated by *Melaleuca cardiophylla* and/or *Hibbertia spicata* low heaths over *Triodia* spp.. Occasionally they are dominated by Acacia low heaths. This community is also characterised by a series of less common species such as *Dysphania plantaginella*, *Hibiscus sturtii*, and *Threlkeldia diffusa* (Keighery and Gibson 1993).

More recent and comprehensive botanical surveys have been undertaken in the Cape Range peninsula regions by DBCA (formerly Department of Environment and Conservation [DEC]) and biological consulting companies. This includes a priority flora search of the Cape Range National Park (DEC 2009) and a Level 1 Flora and Vegetation Assessment on Truscott Crescent Exmouth (360 Environmental 2015). The results of these surveys are summarised below.

Priority Flora Survey, Cape Range National Park (DEC 2009)

The DEC priority search was conducted in September and October of 2009 in the Cape Range National Park. Five priority listed species were recorded in this survey, *Brachychiton obtusilobus* (Priority 4), *Grevillea calcicola* (Priority 3), *Eremophila forrestii* subsp. *capensis* (Priority 3), *Corchorus congener* (Priority 3) and *Tinospora esiangkara* (Priority 2).

Level 1 Flora and Vegetation Assessment of Truscott Crescent, Exmouth (360 Environmental 2015)

360 Environmental conducted a level 1 Flora and Vegetation Assessment on Truscott Crescent, Exmouth in February 2015. The Survey Area was approximately 23.1 ha in size and was located in the Cape Range biogeographic region of Western Australia. A total of 69 taxa were identified during the survey, with the most commonly occurring families being Fabaceae, Poaceae and Asteraceae (360 Environmental 2015).

4.3 Flora and Vegetation Field Results

4.3.1 Overview of Flora

A total of 74 taxa (including species, subspecies, varieties and forms) from 56 genera and 25 families were identified in the Survey Area, of these species three were

introduced flora. The commonly occurring families were Fabaceae (16 taxa), Poaceae (6 taxa), Asteraceae (7 taxa), Poaceae and Malvaceae (both 6 taxa).

Six specimens, *Eucalyptus* sp., *Steptoglossa* sp., *Tecticornia* sp., *Maireana* sp., *Ipomoea* sp. *and Cucumis* sp. could only be identified to genus level and two specimens, Myrtaceae sp. and Malvaceae sp., could only be identified to family level due to the sterile nature of the specimen, and lack of readily identifying features. None of these specimens are thought to be of conservation significance as their features do not resemble any of the Priority listed species identified in the database searches.

The flora inventory is provided in Appendix G, species matrix in Appendix H and the Survey Area data sheets in Appendix I.

4.3.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded in the Survey Area.

One Priority species as listed by DBCA, *Corchorus congener* (Priority 3) was recorded during the survey from 16 locations (

Figure 8 [Plate 1]). *Corchorus congener* is endemic to the Cape Range and is a spreading shrub to 0.6 m, with a preferred habitat of red sand or sandy loam with limestone on sand dunes and plains (WAH 2017).

Plate 1. *Corchorus congener* (Priority 3) recorded in the Survey Area.

4.3.3 Introduced Flora

A total of three introduced species representing 4% of the total taxa were recorded during the survey and are listed in Table 3. None are listed as Declared Pests under the BAM Act or WONS.

Kapok (*Aerva javanica*) was introduced to assist with the revegetation of degraded rangelands. It is now widespread in many types of vegetation from Carnarvon to the Kimberley. Buffel grass (*Cenchrus ciliaris*) is a widespread weed, widely planted in pastoral regions as a pasture grass; it has become common along roadsides, creeklines, river edges and most vegetation types from Shark Bay to the Pilbara and adjacent desert. Mimosa bush (*Vachellia farnesiana*) is also a widespread weed of roadsides, creeks, rivers and disturbed flood plains, from the Kimberley to Carnarvon and occasionally further south (Hussey et al. 2007).

Cenchrus ciliaris was the most commonly occurring introduced species and was recorded from 12 quadrat sites in the Survey Area; *Aerva javanica* was found in two sites and *Vachellia farnesiana* was found in only one location within the Survey Area.

Table 3: Introduced Flora recorded in the Survey Area.

TAXON	(COMMON NAME)
Aerva javanica	Kapok
Cenchrus ciliaris	Buffel grass
Vachellia farnesiana	Mimosa Bush

4.3.4 Vegetation units

Twelve vegetation units were described for the Survey Area, which included ten natural vegetation units, one completely degraded vegetation unit and one unit classed as 'beach'. Descriptions for these vegetation units are presented in Table 4 and their distribution illustrated in Figure 9 and Figure 10.

Table 4: Vegetation Unit Descriptions and Extent in the Survey Area.

Landform	Vegetation Unit Code	Broad Floristic Community	Description	Sites	Area (ha)	Area (%)
Plain	AgTe	*Acacia* shrubland	*Acacia gregorii* low open shrubland over *Triodia epactia* closed grassland	Q1, Q2, Q5, Q22, QE26, QE29	201.45	37.78
Plain	AcAt	*Acacia* shrubland	*Acacia coriacea* and *Acacia tetragonophylla* open shrubland over *Triodia epactia* hummock grassland	Q3, Q21	21.12	3.96
Plain	AsTe	*Acacia* shrubland	*Acacia sclerosperma* subsp. *sclerosperma* shrubland over *Triodia epactia* hummock grassland	Q4, Q19	43.35	8.12
Plain	AbAc	*Acacia* shrubland	*Acacia bivenosa* and *Acacia coriacea* open shrubland over *Spinifex longifolius* and *Triodia epactia* open grassland	Q13, Q14	4.36	0.82
Plain	AbTe	*Acacia* shrubland	*Acacia bivenosa* open shrubland over *Triodia epactia* hummock grassland	Q12, Q15, Q17	84.98	15.91
Plain	Mcte	*Melaleuca* shrubland	*Melaleuca cardiophylla* low shrubland over *Triodia epactia* hummock grassland	Q7, Q18, QE31	18.73	3.50
Plain	SoTe	*Stemodia* shrubland	*Stemodia* sp. Onslow low open shrubland over *Triodia epactia* hummock grassland	Q8, Q16	5.81	1.09
Saline flat	TiFp	*Tecticornia* shrubland	*Tecticornia ?indica* and *Frankenia pauciflora* low shrubland on saline flat	Q10, Q11	13.78	2.58
Dune crest	AsSs	*Acacia* shrubland	*Acacia stellaticeps* and *Scaevola sericophylla* low open shrubland over *Triodia epactia* open grassland	Q6, Q9, QE27, QE28, QE30	119.69	22.41
Drainage line	AcCl	*Cullen* and *Acacia* shrubland	*Acacia coriacea* and *Cullen lachnostachys* shrubland over *Sida rohlenae* subsp. *rohlenae* low shrubland over *Triodia epactia*	Q20, QE25	6.80	1.27
Beach		Coastal area, Rocky and sandy beach only, no vegetation		n/a	7.14	1.34
Completely Degraded		Area cleared of vegetation		n/a	6.52	1.22
				Total	**534**	**100**

4.3.5 Vegetation Condition

Vegetation condition ranged from Very Good to Completely Degraded with the majority of the Survey Area considered to be in Very Good condition (443.30 ha [83.01%]). Vegetation condition mapping is presented in Figure 11 and Figure 12 and the extent described in Table 5. The average fire age of the vegetation was considered very old (>12 years since last fire).

Table 5: Vegetation Condition Extent in the Survey Area.

CONDITION	EXTENT IN SURVEY AREA (HA)	EXTENT IN SURVEY AREA (%)
Very Good	443.30	83.01
Good	66.04	12.37
Poor	6.45	1.21
Degraded	11.34	2.12
Completed Degraded	6.87	1.29
Total	**534**	**100**

4.3.6 Threatened and Priority Ecological Communities

The results from the DPaW Threatened and Priority Ecological Community Database identified no TEC or PECs within the proximity of the Survey Area.

Based on a combination of the database searches and comparison of vegetation present in the Survey Area with descriptions of known PECs and TECs of Pilbara Region (DBCA region boundaries), none of the vegetation units recorded during the survey are likely to represent a TEC or PEC.

4.3.7 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1975)/Shepherd *et al*. (2001) broad vegetation types as much as possible 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).

The vegetation present in the Survey Area is generally consistent with the Shepherd *et al*. (2001) vegetation type mapped in the Survey Area. The State and regional representation of this vegetation unit is presented in Table 6.

Table 6: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of WA 2013).

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent in IUCN Class I-IV Reserves1 (%)
Vegetation Types (Shepherd *et al.* 2001) in the state				
117 (Coastal Dunes)	1,910.10	1,013.77	53.07	-
662 (Coastal Dunes)	284,795.92	282,125.59	99.06	1.82
Vegetation Types (Shepherd *et al.* 2001) in the Carnarvon Bioregion				
117 (Coastal Dunes)	12,424.35	10,907.99	87.80	27.46
662 (Coastal Dunes)	282,709.68	281, 679.32	99.64	1.82
Vegetation Types (Shepherd *et al.* 2001) in the Cape Range Subregion				
117 (Coastal Dunes)	12,424.35	10,907.99	87.80	27.46
662 (Coastal Dunes)	282,709.68	281,679.32	100.00	-

5 Discussion

5.1 Flora Context

A total of 74 taxa (including species, subspecies, varieties and forms) from 56 genera and 25 families were identified in the Survey Area. The commonly occurring families were Fabaceae (16 taxa), Poaceae (6 taxa), Asteraceae (7 taxa), Poaceae and Malvaceae (both 6 taxa).

The species composition was similar between this survey and the 360 Environmental Level 1 survey conducted north of this site on Truscott Crescent, Exmouth in 2015. It is difficult to compare the results directly between the surveys due to the differences in the level of survey and survey area size.

Despite these differences some comparisons can be made. A total of 69 taxa were recorded from the 360 Environmental (2015) Truscott Crescent survey and 74 taxa recorded in this current survey. The most commonly occurring families from the 360 Environmental (2015) Truscott Crescent survey were Fabaceae (14 taxa), Poaceae (10 taxa) which is comparable to the current survey, Fabaceae (16 taxa), Poaceae (6 taxa), Malvaceae (6 taxa) and Asteraceae (7 taxa). Likewise the most frequent genera were also the same between the two surveys, *Acacia* (5 vs 7 taxa from the current survey).

Six specimens from the 2017 surveys, *Eucalyptus* sp., *Streptoglossa* sp., *Tecticornia* sp., *Maireana* sp., *Ipomoea* sp. *and Cucumis* sp. could only be identified to genus level and two specimens, Myrtaceae sp. and Malvaceae sp., could only be identified to family level due to the sterile nature of the specimen, and lack of readily identifying features such as reproductive material.

5.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded. One Priority species, *Corchorus congener* (P3) was recorded occurring in 16 locations within the Survey Area, within six different vegetation types, therefore it is considered likely that more individuals would occur throughout the Survey Area and outside of the survey boundary.

The review of the database searches identified 26 DBCA listed Priority flora occurring in the vicinity of the Survey Area. No Federally Threatened or State listed Threatened species were identified in the searches. Of the 26 Priority listed flora, 22 are considered Unlikely based on a lack of suitable habitat and/or nearby records. The occurrence of two species, *Abutlilon* sp. Quobba (Priority 2) and *Tephrosia* sp. North West Cape (Priority 2) are considered Unknown due to a lack of information on their closest nearby records, however the known habitat of *Abutilon* sp. Quobba consists of brown clayey sand which is not considered to occur in the Survey Area. *Corchorus congener* (Priority

3) was identified in the database search and was recorded during the survey, while *Phyllanthus fuernrohrii* (Priority 3) and *Brachychiton obtusilobus* (Priority 4) occurrence was considered Possible as there is suitable habitat in the Survey Area and records show that the nearest specimens are less than 10 km away from the Survey Area. It is considered likely that these species, if present, would have been identified during the survey.

The majority of the Priority listed taxa identified during the searches are associated with limestone, red sands or rocky soils that are present on the west side of the cape or on the Cape Range. None of these specific habitats (soils) occurred in the Survey Area, consequently the majority of the Priority taxa are considered unlikely to occur in the Survey Area.

5.3 Flora of Interest

No species were recorded during the Survey as being of interest other than as Priority listed flora (e.g. no range extensions).

5.4 Vegetation of Conservation Significance

The results from the DPaW Threatened and Priority Ecological Community Database did not identify any TECs or PECs as occurring in close proximity to the Survey Area. From the previous biological survey conducted by 360 Environmental (2015) in the same region, Cameron's Cave Troglobitic Community was identified in the database search for the survey. Camerons Cave Troglobitic community (obligatory cave inhabitants) is known only from Camerons Cave (karst index C-452) on the Cape Range peninsula (DEC 2012). This community is not thought to occur in the Survey Area as no caves were identified during the current survey and records of this community exist more than 40 km from the Survey Area.

Based on a combination of the database searches, desktop study and comparison of vegetation present in the Survey Area with descriptions of known TECs and PECs of the Pilbara Region (DBCA region boundaries) none of the vegetation units recorded during the survey are considered likely to represent a TEC or PEC.

5.5 ESAs

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. An ESA is mapped as occurring in the northern section of the Survey Area. It is likely that this ESA is not in relation to the values of the flora and vegetation in the Survey Area, and instead part of the underground aquifer, Cape Range Subterranean Waterways system which has been identified in the *Directory of Important Wetlands in Australia* (DPaW 2010). A

large section of this mapped ESA in the Survey Area has been historically cleared, with an existing track running through the northern section of the Survey Area, along with the dominance of weeds (**Cenchrus ciliaris*) and impacts from grazing by sheep.

5.6 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Very Good to Completely Degraded with the majority of the Survey Area considered to be in Very Good condition (443.30 ha). The majority of the vegetation within the Survey Area still retains its vegetation structure; however, some more obvious signs of damage associated with human activity are present. The most significant disturbance was the presence of **Cenchrus ciliaris*. This grass species is present throughout the Survey Area where it is a dominant ground storey species, particularly in the northern section of the Survey Area, where the natural vegetation has been significantly impacted by grazing of sheep. **Cenchrus ciliaris* has been widely planted in pastoral regions as pasture grass; it has become a widespread weed of roadsides, creek lines, river edges and most vegetation types from Geraldton to the Pilbara region. It generates higher fuel loads, is more flammable and increases frequency of fires (Hussey *et al.* 2007). Other commonly noted disturbance included historic clearing, tracks, rubbish and grazing by sheep.

A total of three introduced species were recorded during the survey. None are listed as Declared Pests under the BAM Act or WONS.

5.7 Regional Representation

To encompass current recognised levels of remnant native vegetation retention, the EPA uses a standard level of native vegetation retention of at least 30% of the pre-clearing extent of the ecological communities. These levels have been most recently recognised in the National Objectives and Targets for Biodiversity Conservation 2001-2005, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (EPA 2006).

The Shepherd vegetation units, 117 (Coastal Dunes) and 662 (Coastal Dunes) mapped in the Survey Area have 53.07% and 99.06% pre-European extent remaining at a state level and 87.90% and 99.64% remaining at a bioregional level respectively (Government of WA 2013). This is above the 30% threshold set by the EPA and neither would the clearing of the vegetation within the Survey Area result in it falling below this threshold.

6 Conclusions

The following conclusions can be drawn following completion of the Detailed Flora and Vegetation Assessment:

- The majority of vegetation in the Survey Area is in Very Good condition;
- No TECs or PECs were recorded or are thought to occur in the Survey Area;
- No Threatened species listed under the EPBC Act and/or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey or are expected to occur in the Survey Area;
- One Priority 3 flora species, *Corchorus congener* (P3) was recorded during the survey from 16 locations; and
- The majority of the Survey Area contains moderate levels of the weed grass species, **Cenchrus ciliaris*.

7 References

360 Environmental (2015). Level 1 Flora and Vegetation Assessment, Truscott Crescent Exmouth. Prepared for Tourism Western Australia.

Beard, J. S. (1975). Vegetation Survey of Western Australia 1:1,000,000 Vegetation Series. Map Sheet 5 - Pilbara. University of Western Australia Press, Western Australia.

Bureau of Meteorology [BOM]. (2017). Daily Weather Observations, Commonwealth of Australia. Retrieved May, 2017, from http://www.bom.gov.au/climate

Commonwealth of Australia. (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005*. Commonwealth of Australia, Canberra.

Department of Agriculture and Food WA [DAFWA]. (2012). Soil-landscape mapping. Shapefile.

Department of Agriculture and Food WA [DAFWA]. (2015). Declared Plants in WA. http://www.agric.wa.gov.au/PC_93088.html?s=270181382,Topic=PC_93079\

Department of Environment and Conservation. (2009). Biodiversity of values of basic raw material sites within Cape Range National Park. https://library.dpaw.wa.gov.au/static/FullTextFiles/025313.pdf

Department of Parks and Wildlife. (2010). Cape Range National Park Management Plan No 65 2010. https://www.dpaw.wa.gov.au/images/documents/parks/management-plans/decarchive/cape-range-2010-print-and-web.pdf

Department of Parks and Wildlife [DPaW]. (2013). Weeds Plant Prioritization Process:. Available from http://www.dpaw.wa.gov.au/images/documents/plants-animals/plants/weeds/Weed_Prioritisation_Process_in_DPaW_Nov_2013.pdf

Department of Parks and Wildlife [DPaW]. (2017a). Request for Rare Flora Information (custom search).

Department of Parks and Wildlife [DPaW]. (2017b). Threatened and Priority Ecological Communities Information (custom search).

Department of the Environment [DPaW]. (2017c). NatureMap: Mapping WA's Biodiversity. Department of Parks and Wildlife and Western Australian Museum. Retrieved May 2015, from http://naturemap.dpaw.wa.gov.au

Department of the Environment and Energy [DEE] (2017). *Protected Matters Search Tool*, Accessed from http://www.environment.gov.au/epbc/pmst/index.html, Commonwealth of Australia.

Department of the Environment [DPaW]. (2017e). NatureMap: Mapping WA's Biodiversity. Department of Parks and Wildlife and Western Australian Museum. Retrieved May 2015, from http://naturemap.dpaw.wa.gov.au

Environmental Protection Authority [EPA] (2016a). Environmental Factor Guideline: Flora and Vegetation. Perth: Government of Western Australia, p. 1-6. Available at: http://epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Flora-Vegetation-131216_4.pdf

Environmental Protection Authority [EPA]. (2016b). Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment. Technical report of the Environmental Protection Authority and the Department of Parks and Wildlife.

Government of WA. (2000). Bush Forever: Volume 1: Policies, Principles and Processes. Perth: Department of Environmental Protection.

Government of WA. (2013). 2013 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Accessed [March 2015]. WA Department of Parks and Wildlife, Perth.

Hussey, B. M., Keighery, G. M., Cousens, R. D., Dodd, J. & Lloyd, S. G. Western Weeds. (2007). A Guide to the Weeds of Western Australia. The Plant Protection Society of Western Australia.

Keighery, G. & Gibson, N. (1993). Biogeography and composition of the flora of the Cape Range Peninsula, Western Australia. In The Biogeography of the Cape Range Western Australia, W.F. Humphreys (Ed). Records of the Western Australian Museum, Supplement No 45.

Kendrick, P. & Mau, R. (2002). Carnarvon 1(CAR1- Cape Range sub-region) In A Biodiversity Audit of WA's 53 Biogeographical Subregions. Perth: Department of Conservation and Land Management.

Payne, A. L., Curry, P. J., & Spencer, G. F. (1987). *An Inventory and Condition Survey of Rangelands in the Carnarvon Basin Western Australia* Technical (Bulletin 92). Western Australia: Department of Agriculture.

Shepherd, D. P., Beeston, G. R., & Hopkins, A. J. M. (2001). Native Vegetation in WA (Technical Report 249). Perth: Department of Agriculture.

Thorp, J R, & Lynch, R (2000) *The Determination of Weeds of National Significance*. National Weeds Strategy Executive Committee, Launceston.

Trudgen, M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

WA Herbarium [WAH]. (2017). Florabase - Information on the WA Flora. Accessed from http://florabase.dpaw.wa.gov.au

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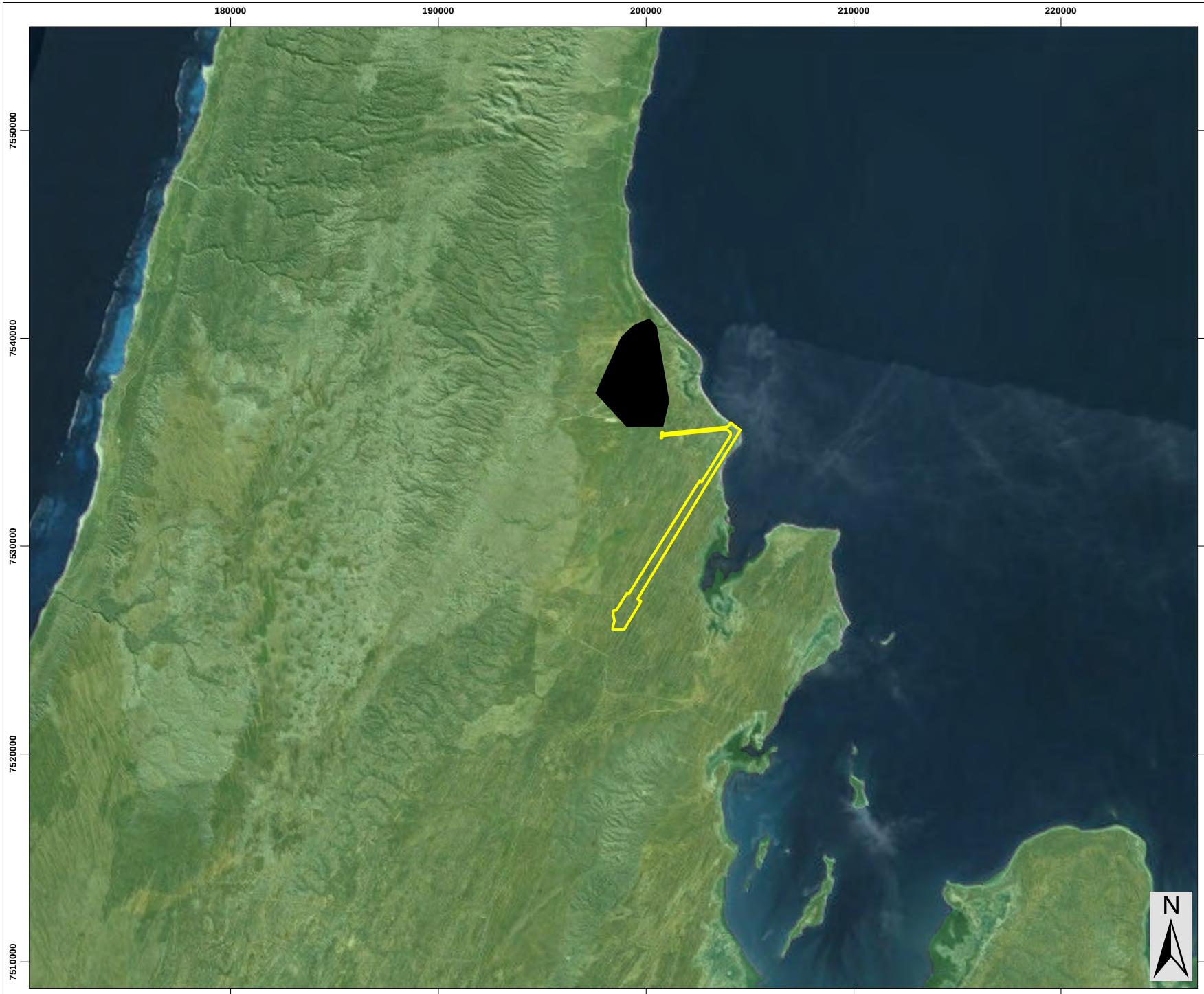
FIGURES



Legend

- Survey Area
- Learmonth RAAF Base

IBRA7 Region

- **Carnarvon** - Cape Range subregion

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- IBRA7 REGOINS SOURCED DOE 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Sep 2013
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LOCALITY MAP

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2198	9/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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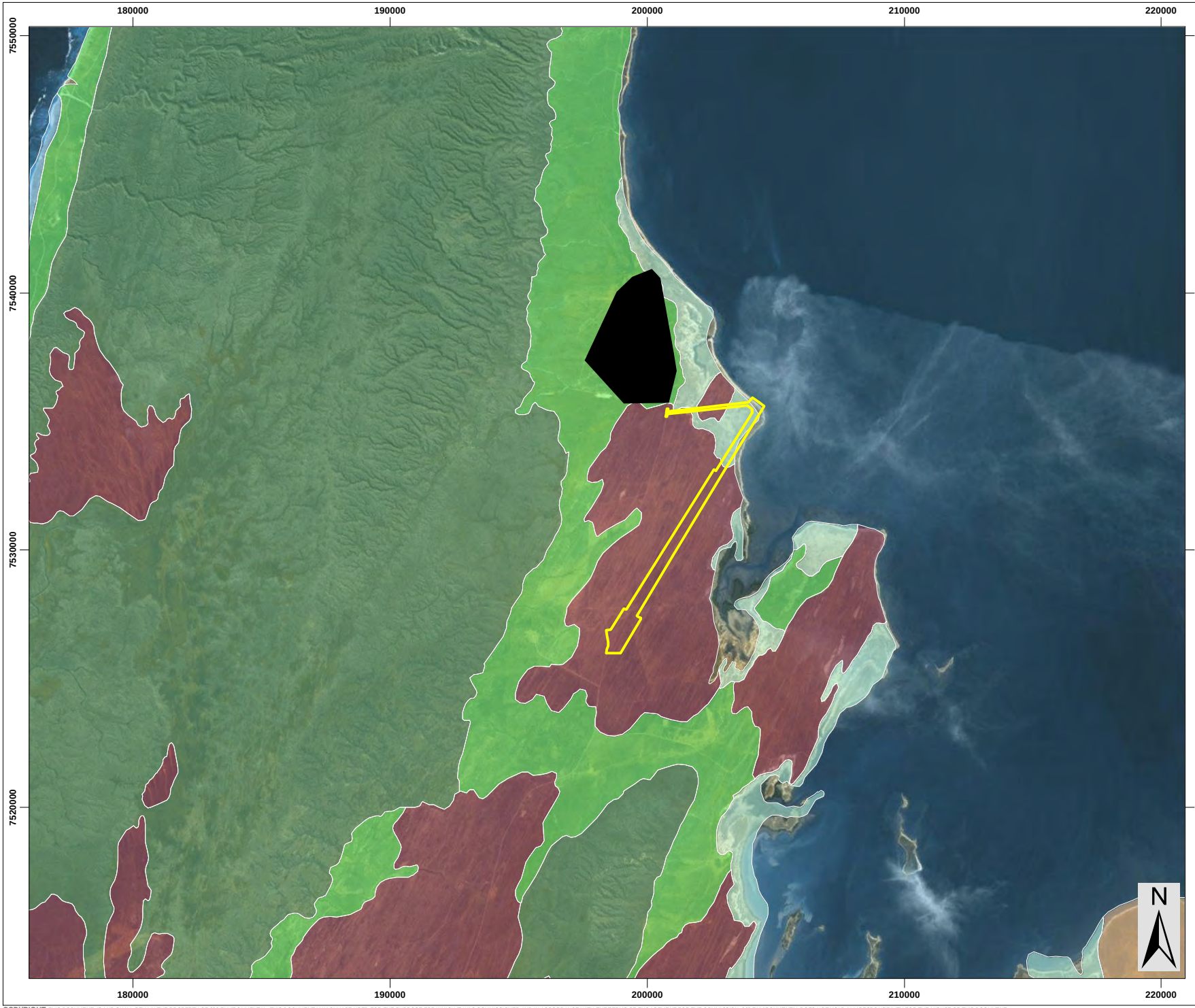
Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 3
IBRA 7 Regions



Legend

Survey Area

Learmonth RAAF Base

Land System

Cardabia System: Undulating sandy plains with linear dunes, minor limestone plains and low rises, supporting mainly soft spinifex hummock grasslands with scattered acacias and other shrubs.

Coast System: Large coastal dunes (some unvegetated) with narrow swales, limestone plains, wave-cut platforms and beaches, supporting diverse tall and low shrublands.

Donovan System: Gently sloping outwash plains and minor stony plains with alkaline loamy and clayey soils supporting tall shrublands of snakewood and other acacias and low shrublands of bluebush.

Learmonth System: Sandy outwash plains marginal to the Cape Range, supporting mainly soft spinifex hummock grasslands with scattered acacia shrubs.

Littoral System: Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests.

Range System: Dissected limestone plateaux, hills and ridges with gorges and steep stony slopes supporting hard spinifex, sparse shrubs and eucalypts.

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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- LAND SYSTEMS SOURCED DAFWA 2012
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Sep 2013
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Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 4
Land Systems

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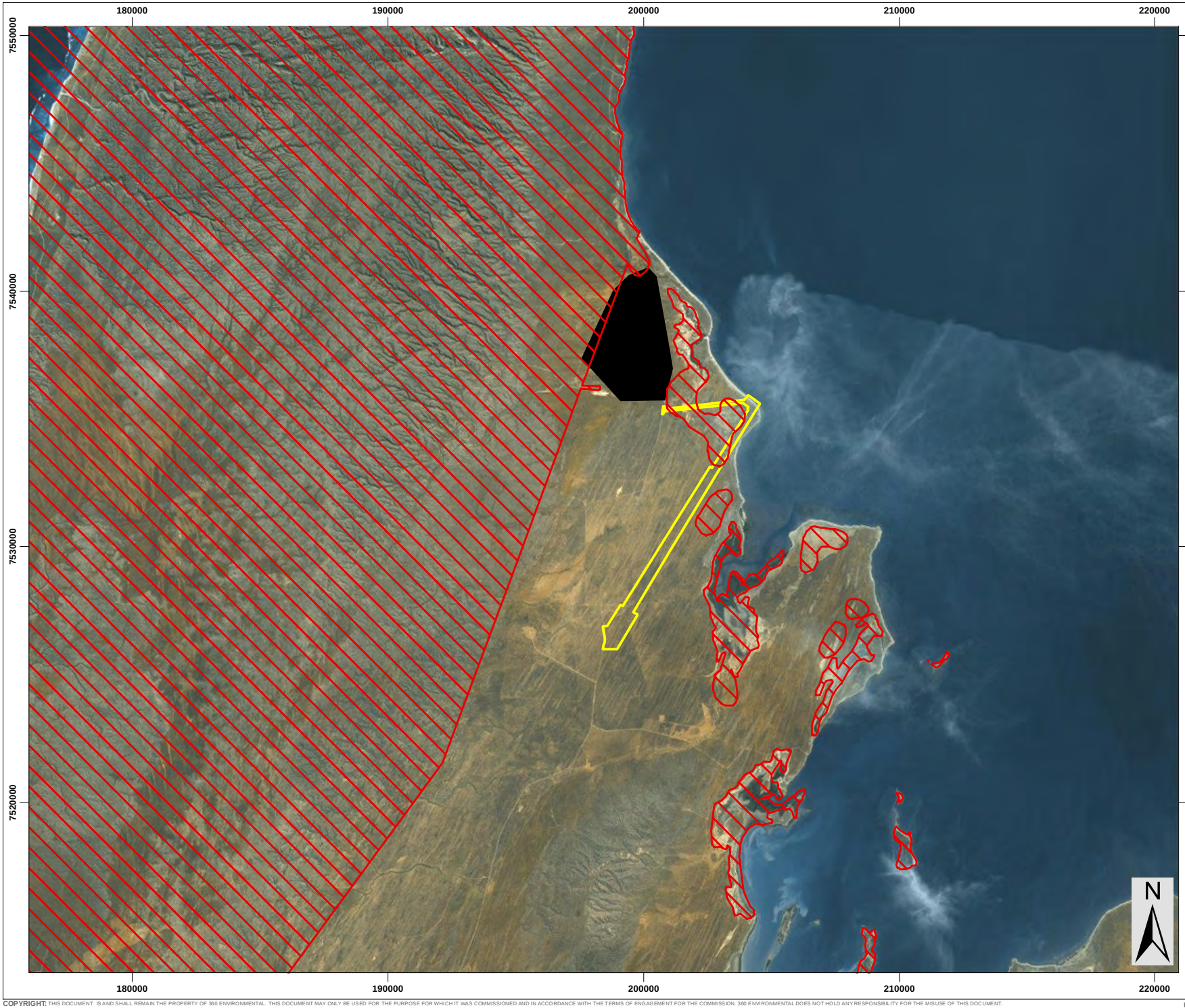

Legend

- Survey Area
- Learmonth RAAF Base
- Environmentally Sensitive Areas

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- ESA SOURCED DER 2014
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Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 5
Environmentally Sensitive Areas

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Legend

- Survey Area (534.01 ha)
- Learmonth RAAF Base
- Quadrats

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

PROJECT ID	DATE
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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 6
Flora Quadrat Locations

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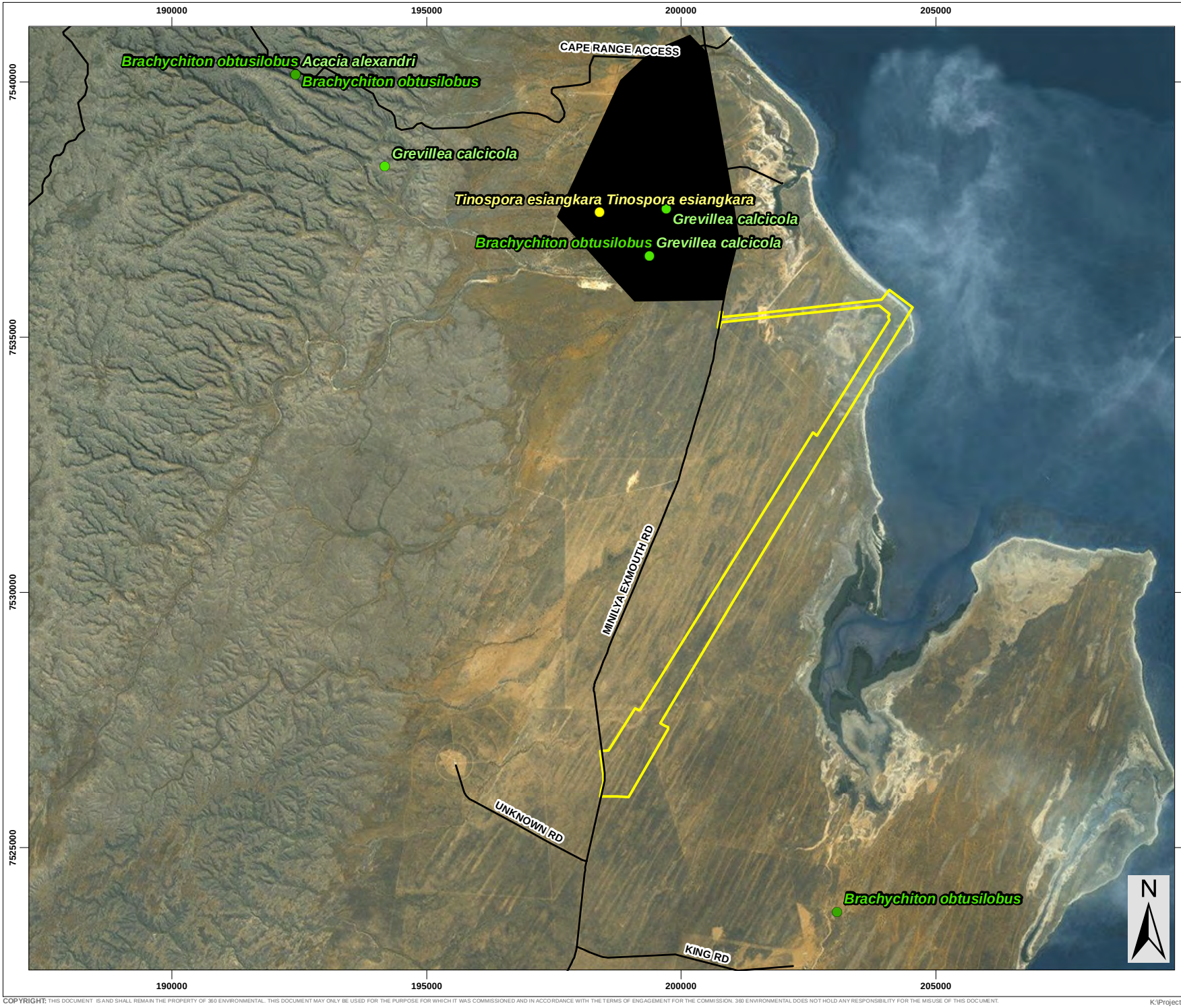

Legend

- Survey Area
- Roads
- Learmonth RAAF Base

Rare and Priority Flora

- Priority 1
- Priority 2
- Priority 3
- Priority 4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- CADASTRE SOURCED FROM LANDGATE
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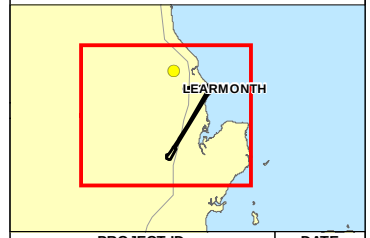
LOCALITY MAP



PROJECT ID	DATE
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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 7
Rare and Priority Flora (DPaW Records)

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Legend

- Survey Area
- Roads
- Learmonth RAAF Base

Surveyed Priority Flora

- Priority 3 (*Corchorus congener*)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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- CADASTRE SOURCED FROM LANDGATE
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LOCALITY MAP

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2061	9/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

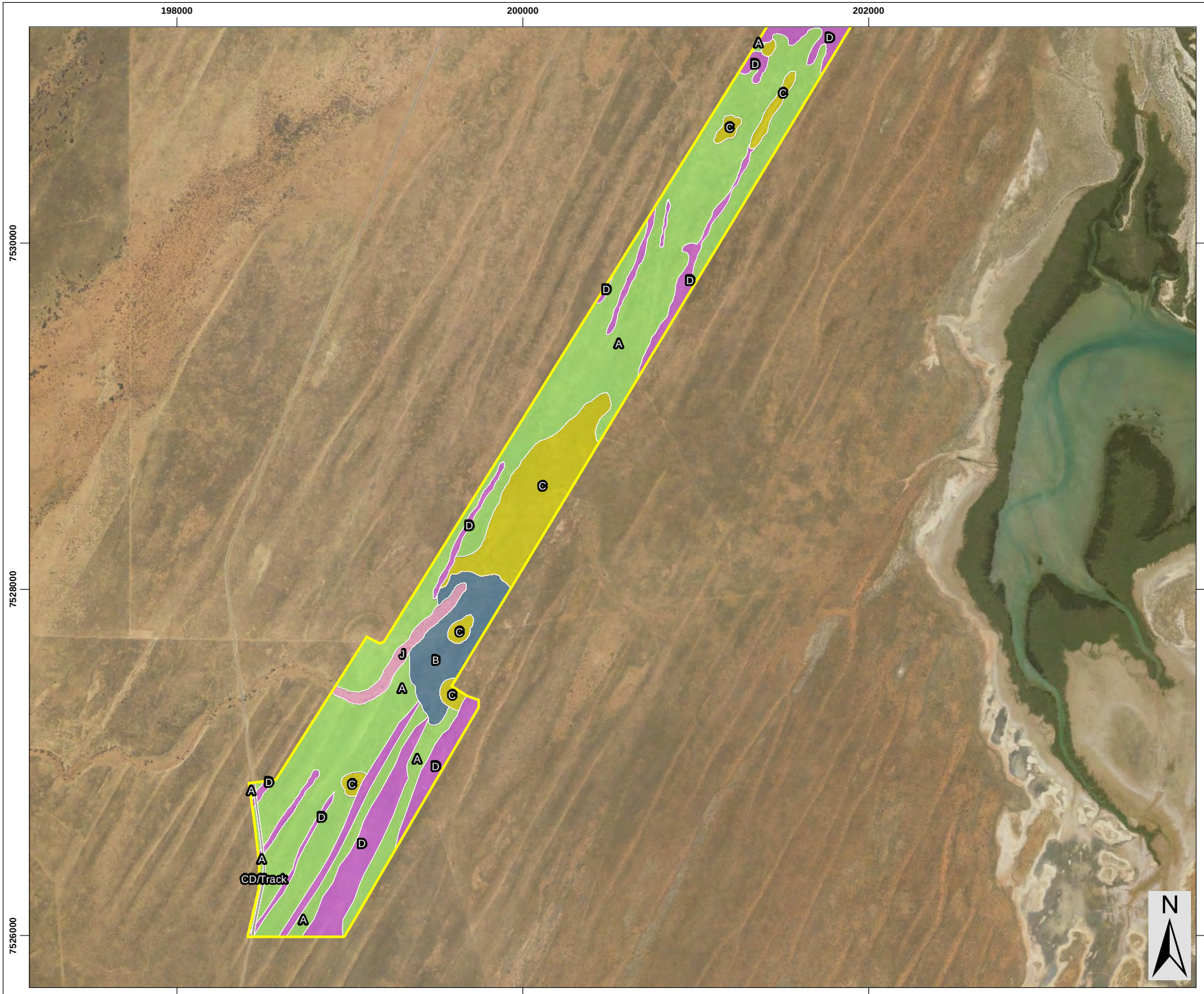
CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 8
Rare and Priority Flora (Surveyed)

K:\Projects\1.0 EBS\2198 Subsea 7 Eco Surveys\Figures\2198 Figure 7 Rare and Priority Flora (Surveyed).mxd



Legend

- Survey Area (534.01 ha)
- Learmonth RAAF Base
- **A:** AgTe: *Acacia gregorii* low open shrubland over *Trioida epactia* closed grassland (201.75 ha)
- **B:** AcAt: *Acacia coriacea* and *Acacia tetragonophylla* open shrubland over *Triodia epactia* hummock grassland (21.12 ha)
- **C:** AsTe: *Acacia sclerosperma subsp. sclerosperma* shrubland over *Triodia epactia* hummock grassland (43.35 ha)
- **D:** AsSs: *Acacia stellaticeps* and *Scaevola sericophylla* open shrubland over *Triodia epactia* hummock grassland (119.68 ha)
- **E:** McTe: *Melaleuca cardiophylla* low shrubland over *Triodia epactia* hummock grassland (18.73 ha)
- **F:** TiFp: *Tecticomia ?indica* and *Frankenia pauciflora* low shrubland on saline flat (13.78 ha)
- **G:** AbTe: *Acacia bivenosa* open shrubland over *Triodia epactia* hummock grassland (84.98 ha)
- **H:** SoTe: *Stemodia sp. Onslow* low open shrubland over *Triodia epactia* hummock grassland (5.81 ha)
- **I:** AbAc: *Acacia bivenosa* and *Acacia coriacea* open shrubland over *Spinifex longifolius* and *Triodia epactia* open grassland (4.36 ha)
- **J:** AcC: *Acacia coriaecea* and *Cullen sp.* shrubland over *Sida rohlenae subsp. rohlenae* low shrubland over *Triodia epactia* (6.80 ha)
- **Beach:** Beach (7.13 ha)
- **CD/Track:** CD: Completely Degraded/Track (6.51 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- IBRA7 REGOINS SOURCED DOE 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Sep 2013
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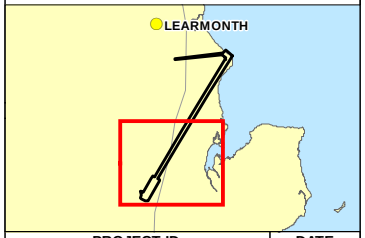
LOCALITY MAP



PROJECT ID	DATE
2198	9/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 9
Vegetation Associations

K:\Projects\1.0 EBS\2198 Subsea 7 Eco Surveys\Figures\2198 Figure X Vegetation Associations.mxd

Legend

- Survey Area (534.01 ha)
- Learmonth RAAF Base
- **A:** AgTe: *Acacia gregorii* low open shrubland over *Trioida epactia* closed grassland (201.75 ha)
- **B:** AcAt: *Acacia coriacea* and *Acacia tetragonophylla* open shrubland over *Triodia epactia* hummock grassland (21.12 ha)
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- **E:** McTe: *Melaleuca cardiophylla* low shrubland over *Triodia epactia* hummock grassland (18.73 ha)
- **F:** TiFp: *Tecticornia ?indica* and *Frankenia pauciflora* low shrubland on saline flat (13.78 ha)
- **G:** AbTe: *Acacia bivenosa* open shrubland over *Triodia epactia* hummock grassland (84.98 ha)
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- **Beach:** Beach (7.13 ha)
- **CD/Track:** CD: Completely Degraded/Track (6.51 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- IBRA7 REGOINS SOURCED DOE 2015
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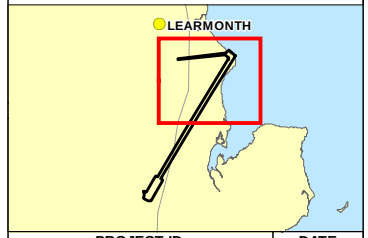
LOCALITY MAP



PROJECT ID	DATE
2198	9/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 10
Vegetation Associations

K:\Projects\1.0 EBS\2198 Subsea 7 Eco Surveys\Figures\2198 Figure X Vegetation Associations.mxd

Legend

Survey Area (534.01 ha)

Vegetation Condition

- **VG:** Very Good (443.30 ha)
- **G:** Good (66.04 ha)
- **P:** Poor (6.45 ha)
- **D:** Degraded (11.34 ha)
- **CD:** Completely Degraded (6.87 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- IBRA7 REGOINS SOURCED DOE 2015
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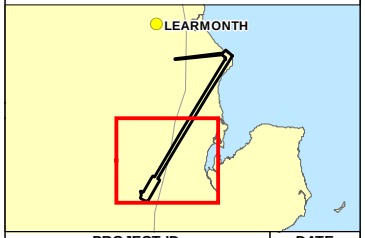
LOCALITY MAP



PROJECT ID	DATE
2198	2/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 11
Vegetation Condition

Legend

- Survey Area (534.01 ha)
- Learmonth RAAF Base

Vegetation Condition

- **VG:** Very Good (443.30 ha)
- **G:** Good (66.04 ha)
- **P:** Poor (6.45 ha)
- **D:** Degraded (11.34 ha)
- **CD:** Completely Degraded (6.87 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- IBRA7 REGOINS SOURCED DOE 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Sep 2013
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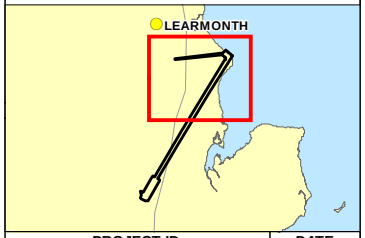
LOCALITY MAP



PROJECT ID	DATE
2198	2/10/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	SF	SS	0

Subsea 7
Bundle Site, Learmonth

Flora and Vegetation Assessment

Figure 12
Vegetation Condition

APPENDIX A

Definition of Declared Rare / Priority / Threatened Flora

Categories of Declared Rare Flora (WC Act) and Priority listings (DPaW)

CONSERVATION CODE	DESCRIPTION
X	Presumed Extinct Flora (Declared Rare Flora – Extinct) "Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*)."
T	Threatened Flora (Declared Rare Flora – Extant) "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*)." "Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; EN: Endangered – considered to be facing a very high risk of extinction in the wild; VU: Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	Priority One: Poorly-known taxa "Taxa which are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."
P2	Priority Two: Poorly-known taxa "Taxa which are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."
P3	Priority Three: Poorly-known taxa "Taxa which are known from collections or sight records from several localities not under imminent threat, or few but widespread localities with

Conservation Code	Description
	either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them."
P4	**Priority Four: Rare, Near Threatened and other taxa in need of monitoring** a. Rare. "Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands." b. Near Threatened. "Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable." c. "Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."
P5	**Priority Five: Conservation Dependent taxa** "Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years."

Source: Department of Parks and Wildlife (2017). Online: http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions.pdf.

APPENDIX B

Definition of Threatened and Priority Ecological Communities

Definitions of Threatened Ecological Communities as Endorsed by the Western Australian Minister for the Environment

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B);

A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)

ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)

ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2010). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/tecs/tec-definitions-dec2010.pdf

Definitions of Priority Ecological Communities as listed DPaW

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list.

These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities.

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Environment and Conservation (2010). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, WA. Online: http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/tecs/tec-definitions-dec2010.pdf

APPENDIX C

Environmental Weeds and Declared Plant Categories

Criteria used for Ranking Environmental Weeds

The Weed Prioritisation Process for DPaW contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Potential Distribution** – Area of potential habitat in the Region that could be occupied or the area at risk of invasion by the weed;
- **Current Distribution -** Area of habitat in the Region currently occupied by the weed, in relation to the habitat that it could invade;
- **Ecological Impact -** Impact of species within the Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure, composition and function of ecosystems);
- **Invasiveness** – rate of spread of a weed in native vegetative, encompassing factors of establishment, reproduction and long distance dispersal (>100m); and
- **Feasibility of Control** - The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Is it feasible to eradicate or at least contain the infestation?

Source: DPaW (2013). Weed Prioritisation Process for DPaW (formerly DEC) – "An integrated approach to Weed Management on DPaW-managed lands in WA"

Standard Meanings of Declared Plant Categories

Under the Biosecurity and Agriculture Management Act 2007 (the BAM Act), all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are not established in WA and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in WA in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in WA but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Source: Department of Agriculture and Food, WA. Online: http://www.biosecurity.wa.gov.au/western-australian-organism-list-waol

APPENDIX D

Vegetation Condition Scale

Condition Scale Code	Condition Scale
E	**Excellent** Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
VG	**Very Good** Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
G	**Good** More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
P	**Poor** Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
D	**Degraded** Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
CD	**Completely Degraded** Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Source: Trudgen Vegetation Condition Scale as developed by Trudgen (1988).

APPENDIX E

Database Searches

Taxon	ConsStatus	PopNumbe	Gda94L	Gda94	Location	District	Vesting	Purpose1	MatureCou	JuvenileCo	SeedlingCo	LiveTotal	AreaOccup	inFlower
Acacia alexandri	3	1	-22.1	114	5.3 km wes	EXMOUTH	PLB	PAS	0	0	0	0	0	Y
Acacia alexandri	3	2	-22	114	9.6 km wes	EXMOUTH	NON	UCL	0	0	0	0	0	N
Acacia alexandri	3	3	-22.1	114	Charles Kni	EXMOUTH	PLB	PAS	0	0	0	1	0	N
Acacia alexandri	3	4	-22.1	114	Charles Kni	EXMOUTH	PLB	PAS	0	0	0	0	0	N
Acacia alexandri	3	5	-22.1	114	Charles Kni	EXMOUTH	CC	NPK	0	0	0	0	0	N
Acacia alexandri	3	6	-22.3	114	Top of Cap	EXMOUTH	CC	NPK	0	0	0	0	0	Y
Acacia alexandri	3	7	-22	114	About 8 km	EXMOUTH	NON	UCL	286	0	0	286	0	N
Acacia alexandri	3	7	-22	114	About 8 km	EXMOUTH	WAT	WAT	0	0	0	0	0	N
Acacia alexandri	3	7	-22	114	About 8 km	EXMOUTH	NON	UCL	0	0	0	0	0	N
Acacia alexandri	3	7	-22	114	About 8 km	EXMOUTH	PRI		2500	0	0	2500	0	N
Acacia ryaniana	2	4	-22.2	114	Sandy Bay	EXMOUTH	CC	NPK	0	0	0	0	0	N
Acacia startii	3	1	-22.7	114	5 km east c	EXMOUTH	MRD	VER	0	0	0	0	0	N
Acacia startii	3	3	-22.7	114	13.2 km alc	EXMOUTH	MRD	VER	0	0	0	0	0	N
Acacia startii	3	4	-22.7	114	About 60 k	EXMOUTH	EXD	EPL	0	0	0	0	0	Y
Acacia startii	3	5	-22.7	114	About 66 k	EXMOUTH	EXD	EPL	0	0	0	0	0	Y
Acacia startii	3	6	-22.7	114	About 74.6	EXMOUTH	PLB	PAS	0	0	0	0	0	Y
Acacia startii	3	7	-22.7	114	About 81 k	EXMOUTH	MRD	VER	0	0	0	0	0	Y
Acacia startii	3	11	-22.7	114	About 16.5	EXMOUTH	MRD	VER	0	0	0	0	0	Y
Acacia startii	3	13	-22.5	114	[Near] Cap	EXMOUTH	PLB	PAS	0	0	0	0	0	Y
Acanthocarpus rupestris	2	1	-22	114	UCL. 6 km a	EXMOUTH	NON	UCL	0	0	0	0	0	N
Acanthocarpus rupestris	2	2	-22	114	UCL. 3.5 mi	EXMOUTH	NON	UCL	0	0	0	0	0	Y
Acanthocarpus rupestris	2	3	-22.1	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	0	0	N
Acanthocarpus rupestris	2	4	-22.2	114	Walk-track	EXMOUTH	CC	NPK	0	0	0	0	0	N
Corchorus congener	3	2	-22.3	114	N of Yardie	EXMOUTH	CC	NPK	0	0	0	0	0	N
Corchorus congener	3	3	-22	114	UCL. Cape I	EXMOUTH	NON	UCL	0	0	0	0	0	Y
Corchorus congener	3	5	-22.4	114	Road Reser	EXMOUTH	MRD	VER	0	0	0	35	0	Y
Corchorus congener	3	6	-22.6	114	Ex-Giralia L	EXMOUTH	NON	EPL	0	0	0	0	0	Y
Crinum flaccidum	2	2	-22.3	114	5 miles (8.(	EXMOUTH	CC	NPK	0	0	0	0	0	N
Crinum flaccidum	2	3	-22.2	114	Pilgramunr	EXMOUTH	CC	NPK	0	0	0	0	0	Y
Daviesia pleurophylla	2	1	-21.9	114	In dune ca	EXMOUTH	LGA	FIR	0	0	0	0	0	Y
Daviesia pleurophylla	2	2	-22.4	114	Learmonth	EXMOUTH	COM	DEF	0	0	0	0	0	N
Eremophila occidens	2	1	-22.1	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	0	0	Y
Grevillea calcicola	3	1	-22.1	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	0	0	N
Grevillea calcicola	3	2	-22.1	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	0	0	Y
Grevillea calcicola	3	3	-22.4	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	0	0	N
Harnieria kempeana subsp. r	2	1	-22	114	77 Learmo	EXMOUTH	WAT	WAT	0	0	0	20	0	Y
Harnieria kempeana subsp. r	2	2	-22.1	114	Cape Range	EXMOUTH	CC	NPK	0	0	0	4	0	Y
Tinospora esiangkara	2	1	-22	114	Cape Range	EXMOUTH	MWA	WAT	0	0	0	0	0	N
Tinospora esiangkara	2	2	-22	114	UCL. North	EXMOUTH	NON	UCL	0	0	0	0	0	Y
Verticordia serotina	2	1	-22.3	114	Yardie Cree	EXMOUTH	CC	NPK	0	0	0	0	0	Y

Taxon	Status	Rank	DPaWRegic	DPaWDistr	Distributior	FloweringPeriod
Acacia alexandri		3	PILB	EXMOUTH	Cape Range	Jun-Sep
Acacia startii		3	MWST,PILB	EXMOUTH,	Cape Range	Jul-Aug
Corchorus congener		3	PILB	EXMOUTH,	Exmouth, N	Apr-Oct
Cyperus victoriensis		1	KIMB,PILB	EXMOUTH,	Oobagooma, E of Exmouth	
Dysphania congestiflora		3	PILB	EXMOUTH,	Fortescue N	Jun-Aug
Eremophila youngii subsp. lepidota		4	GOLD,MWS	KALGOORL	Exmouth, F	Mar,Jun
Grevillea calcicola		3	PILB	EXMOUTH	Cape Range	Aug,Sep
Tephrosia sp. North West Cape (G. Marsh 81)		2	PILB	EXMOUTH	Exmouth	May

Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes	Locality	Latitude	Longitu	Geocod	Preci	Collector	Coll_Num
Abutilon sp	2	Annual her	Plain. Brow	Low shrubl	6-20 plants		Cape Range	-22.306	113.8	GPS	1	J. English	JE 0234
Acacia alex	3	Open bush					Shothole C	-22.033	114.1	MAN	2	W.B. Edgec	s.n.
Acacia alex	3	erect shrut	steep rocky	Acacia bive			5.3 km W c	-22.133	114	AUTO	3	B.R. Maslin	6284
Acacia alex	3	Spreading s	E slope of r	Open malle	solitary.		On Charles	-22.117	114.1	MAN	0	S.D. Hoppe	5085
Acacia alex	3	Shrub to 3.					Cape Range	-21.95	114	MAN	4	A.S. George	1334
Acacia alex	3	Slender shr					Cape Range	-21.95	114	MAN	4	A.S. George	2479
Acacia alex	3	Slender shr					Cape Range	-21.95	114	MAN	4	A.S. George	2479
Acacia alex	3	Open bush					Shothole C	-22.05	114	MAN	2	W.B. Edgec	12
Acacia alex	3	Open bush					Shothole C	-22.033	114.1	MAN	2	W.B. Edgec	s.n.
Acacia alex	3	Slender tre	In rocky gu		local occur		Cape Range	-21.953	114	AUTO	3	K.L. Tinley	s.n.
Acacia alex	3						6 km from	-22.05	114.1	MAN	2	Y. Chadwic	s.n.
Acacia alex	3	Much bran	Growing or				5.3 km W c	-22.133	114	MAN	2	K.F. Kennea	7344
Acacia alex	3	Spindly ope	Banks of st				Cape Range	-22.4	113.8	MAN	4	B.R. Maslin	6289
Acacia alex	3	Whispy shr	Growing in	With (KFK			9.6 km W c	-22.067	114.1	MAN	2	K.F. Kennea	7337
Acacia alex	3						6 km from	-22.05	114.1	MAN	2	Y. Chadwic	1353
Acacia alex	3	Glabrous sh	Gradual slo	Open shrut			On Charles	-22.1	114	MAN	0	S.D. Hoppe	5088
Acacia alex	3	Sterile, spr	Gravel pit,	Eucalyptus			On Charles	-22.1	114	MAN	0	S.D. Hoppe	5086
Acacia alex	3	Perennial,	Flood plain	Tall shrubl	2-5 plants.		Cape Range	-22.005	113.9	GPS	1	J. English	JE 0242
Acacia alex	3	Slender shr	In limeston	In tall open			Cape Range	-22.217	114	MAN	3	A.S. George	10270
Acacia alex	3	Open bush					Shothole C	-22.05	114	MAN	2	W.B. Edgec	13
Acacia ryar	2	? Low shrul	Coastal dur			Latitude an	Sandy Bay (	-22.217	113.8	TOPO	3	H. Pringle	s.n.
Acacia ryar	2	Low spreac	Leeward sic	Amongst Sp			12 km S Ta	-22	113.9	UNK	3	A.N. Start	s.n.
Acacia ryar	2	Prostrate sl	On coastal				N of Yardie	-22.2	113.8	MAN	3	A.S. George	6660
Acacia star	3	Dense canc	Hillslope as				Ca 60 km fr	-22.667	114.2	MAN	0	S.D. Hoppe	5058
Acacia star	3	Dense rour	In flat coun	With Acaci		Abundance	13.2 km E a	-22.667	114.1	MAN	2	A.R. Chapm	593
Acacia star	3	Dense rour	On slope b	With A. tet		Abundance	Cape Range	-22.4	113.8	MAN	4	A.R. Chapm	597
Acacia star	3	Compact rc	Low limest	With Triodi		Abundance	16.5 km E c	-22.5	114.2	MAN	4	B.R. Maslin	6283
Acacia star	3	Compact rc	Flat betwe	Triodia dor		Abundance	Cape Range	-22.4	113.8	MAN	4	B.R. Maslin	6292
Acacia star	3	Low wattle	Stony hills.	With spinif			Rough Ran	-22.483	114	MAN	3	J.S. Beard	3549
Acacia star	3	Reasonably	On flat on g	In shrublan		Abundance	Cape Range	-21.983	114	MAN	4	P.C. Ryan	D
Acacia star	3	Dense rour	On top of li	In Acacia, T		Abundance	16.6 km E a	-22.658	114.2	MAN	2	A.R. Chapm	595
Acacia star	3	Spreading s	Broad flat,	Open low s			Ca 81 km N	-22.683	114.1	MAN	0	S.D. Hoppe	5062
Acacia star	3	Shrub to 1	Pale red sa	In low scru	abundant.		5 km E of B	-22.667	114.1	MAN	3	A.N. Start	7
Acacia star	3	Round shru	On thin pal	Growing w	frequent.		Approx 10	-22.65	114.2	MAN	3	A.N. Start	65
Acacia star	3	Spreading s	Broad flat b	Scrub of Ac			Ca 74.6 km	-22.667	114.1	MAN	0	S.D. Hoppe	5061
Acacia star	3	Spreading s	Gradual hil	Open low s	common.		Ca 66 km fr	-22.667	114.1	MAN	0	S.D. Hoppe	5059
Acacia star	3	Round shru	On pale loa	Growing w	frequent.		Approx 10	-22.65	114.2	MAN	3	A.N. Start	16
Acacia star	3	Round shru	In thin pale	Growing w	frequent.		Approx 10	-22.65	114.2	MAN	3	A.N. Start	16
Acacia star	3	Spreading s	Gradual slo		common.		Ca 60 km fr	-22.667	114.2	MAN	0	S.D. Hoppe	5054
Acacia star	3	dense, roui	pale red loa	Acacia tetr			Cape Range	-22.4	113.8	MAN	4	A.R. Chapm	596
Acacia star	3	Shrub to 1	In pale red	In low scru	abundant.		5 km E of B	-22.667	114.1	MAN	3	A.N. Start	7
Acacia star	3	Shrub <1 m	In sandy loa	In associati	occasional.		22 km W of	-22.667	113.9	UNK	3	A.N. Start	s.n.
Acacia star	3	Round shru	On thin pal	Growing w	frequent.		Approx 10	-22.65	114.2	MAN	3	A.N. Start	65
Acanthocar	2	Prickly shru	Upslope fro	Rock heath			Walk-track	-22.15	113.8	MAN	3	S.D. Hoppe	5074
Acanthocar	2						6 km along	-22.05	114.1	MAN	2	D.W. Good	1371
Acanthocar	2		In limeston				Cape Range	-22.117	114	MAN	4	A.S. George	6543
Acanthocar	2	Flowers wh	In red sand				3.5 miles S	-21.983	114.1	MAN	3	A.S. George	6590
Acanthocar	2	Flowers sm	Among roc				Cape Range	-21.95	114	MAN	3	R.D. Royce	8378
Brachychito	4	Tree with y					1.3 W of Le	-22.25	114.1	MAN	0	C. Blumer	s.n.
Brachychito	4						5 km S of Y	-21.883	114	MAN	3	Y. Chadwic	1404
Brachychito	4	Tree to 3 m	Growing in				Edge of Cap	-21.85	114.1	MAN	0	K.F. Kennea	7370
Brachychito	4	Tree ca 5 m	Limestone	With low tr			Charles Kni	-22.1	114	MAN	4	R. Pullen	10.952
Brachychito	4	Tree 15 ft.	Sandy plair	Spinifex an		Kurrajong.	Between E	-21.933	114.1	MAN	3	J.S. Beard	3557
Brachychito	4	Tree, leave					Site 3 Cape	-22.367	113.9	MAN	0	J.M. Waldo	s.n.
Brachychito	4	Spreading t	At base of g			A small tre	Charles Kni	-21.95	114	MAN	4	A.S. George	1323
Brachychito	4	Spreading t	On hill top			A small tre	Cape Range	-22.117	114.1	MAN	3	A.S. George	1323
Brachychito	4	Tree to 5 m	In rocky lim	In open shr			Cape Range	-22.217	114	MAN	0	A.S. George	10268
Brachychito	4	Tree to 5 m	In rocky lim	In open shr			Cape Range	-22.217	114	MAN	0	A.S. George	10268
Brachychito	4	Tree 5 m.	In rocky, lir				Charles Kni	-22.1	114	MAN	0	A.S. George	s.n.
Brachychito	4		Range land		scattered t		Exmouth G	-22.367	114.1	MAN	4	J. Stretch	s.n.
Brachychito	4	Fine large t	Marginal re	Shrubs sma	several see		Charles Kni	-22.1	114	GPS	1	J. Dennis	189
Carpobrotu	3	Perennial g	On rocky ri	Low shrubl	2-5 plants.		Cape Range	-22.324	113.8	GPS	1	J. English	JE 0109
Corchorus	3					Card ref. 6(	Hall Street,	-21.939	114.1	GPS	1	DEC Exmou	s.n.
Corchorus	3						2 km E of L	-21.935	114.1	AUTO	3	Y. Chadwic	1338
Corchorus	3	More or les	Limestone				Ca 1 miles S	-21.953	114	AUTO	4	A.S. George	2563
Corchorus	3	Spreading s	On sandy p				N of Yardie	-22.316	113.9	AUTO	4	A.S. George	6671

Corchorus	3			Shrubland.			Cape Range	-22.467	113.7	MAN	3	S. Hunger &		4155
Corchorus	3	Subshrub, f		Shrub vege			Cape Range	-22.047	114.1	MAN	3	S. Hunger &		4201
Corchorus	3	Perennial,	Plain. Rang	Low shrubl	21-50 plant	Population	Exmouth-M	-22.433	114	GPS	1	J.E. Wajon		1351
Corchorus	3	Perennial,	Plain. Brow	Low shrubl	6-20 plants		Cape Range	-22.25	113.9	TOPO	3	J. English	JE 0255	
Corchorus	3	Spreading s	In red loam				5-6 miles S	-22.014	114.1	AUTO	3	A.S. George		6604
Crinum flac	2		In red sand				5 miles N o	-22.244	113.9	AUTO	3	A.S. George		6681
Crinum flac	2	Erect in clu	Low lying a	Hummock		Abundance	Pilgramunr	-22.195	113.9	AUTO	3	R. Karniewi	RBK 119	
Crinum flac	2						Cape Range	-22.183	113.9	TOPO	3	T. Tapper		21
Daviesia pl	2	Much bran	On sand du	In shrub ste			W side of C	-22.25	113.9	MAN	0	A.S. George		10288
Daviesia pl	2	Broom-like	N-S sand di	Shrubland	abundant.		Exmouth, H	-21.882	114.1	MAN	2	M.D. Crisp	MDC 9380	
Eremophila	3	Shrubs to 1	On limesto	Amongst M	common.		2.9 km E of	-22.1	114	UNK	2	R.J. Chinno		6903
Eremophila	3						Summit of	-21.983	114	TOPO	3	K.M. McWl	s.n.	
Eremophila	3	Spindly shr	On limesto	Spinifex an			Charles Kni	-21.983	114	TOPO	3	J.S. Beard		3571
Eremophila	3	Shrub 70-1					Cape Range	-21.983	114	TOPO	3	A.S. George		1326
Eremophila	3	Perennial s	Ridge. Brov	Low shrubl	2-5 plants.	Reproducti	ca 4 km E o	-22.237	113.9	GPS	1	J. English		56
Eremophila	3	Shrub to 1.					Cape Range	-21.983	114	TOPO	4	A.S. George		2460
Eremophila	2	Erect open	Dune in rar	Medium tr	6 - 20 plant	Population	150 m W o	-21.967	114	TOPO	3	R.J. Dadd		39
Eremophila	2	Shrub, seve	Extensive li	Open heatl	rare.		Cape Range	-22.1	114	MAN	2	M.E. Ballin		1858
Eremophila	4	Straggly sh	Red soil.				56 km on E	-21.935	114.1	AUTO	3	H. Demarz		11306
Eremophila	4	Dense spre	Firecracker				Bungarra D	-22.712	114.2	GPS	1	M. Maier, H	GIRBUNG -	
Eremophila	4	Dense spre	Firecracker				Bungarra D	-22.712	114.2	GPS	1	M. Maier, H	GIRBUNG -	
Grevillea ca	3	Shrub 4 m;	In limeston				Cape Range	-22.233	114	MAN	0	A.S. George		10265
Grevillea ca	3						5 miles S of	-21.956	114	AUTO	3	Y. Chadwic		1393
Grevillea ca	3						7 km from	-22.117	114	MAN	3	Y. Chadwic		1348
Grevillea ca	3	Several ste	On limesto				Cape Range	-21.927	114	AUTO	3	A.S. George		6613
Grevillea ca	3	Tree 3 m hi					Learmonth	-22.242	114.1	AUTO	3	D.W. Good		1168
Grevillea ca	3	Flowers cre					Cape Range	-22.067	114	MAN	0	Hj. Eichler		22584
Grevillea ca	3						5 miles S of	-21.956	114	AUTO	3	Y. Chadwic		1393
Grevillea ca	3						Cape Range	-21.98	114	AUTO	4	T. Tapper		77
Grevillea ca	3	Shrub 3-4 r					Cape Range	-22.083	114.1	MAN	3	A.S. George		1331
Grevillea ca	3	Shrub 3-4 r					Cape Range	-22.083	114.1	MAN	3	A.S. George		1331
Grevillea ca	3	Tree; flowe					Cape Range	-22.25	114.1	MAN	0	J.M. Waldo	s.n.	
Harnieria k	2						Cape Range	-21.98	114	AUTO	4	T. Tapper		64
Harnieria k	2	Straggling s					W of No. 2	-21.953	114	AUTO	4	A.S. George		6547
Harnieria k	2	Shrub 1 m;	Among lim				Cape Range	-21.953	114	MAN	4	A.S. George		1311
Harnieria k	2	Sprawling p	On a gently	Eucalyptus	the popula	Another pc	North West	-22.033	114.1	TOPO	3	M.E. Trudg		12864
Harnieria k	2	Perennial s	Watercour	Low shrubl	2-5 plants.	Prefers sha	Mandu Ma	-22.15	113.9	GPS	1	J. English		95
Harnieria k	2	Shrub 1 m;	Among lim				Cape Range	-21.953	114	AUTO	4	A.S. George		1311
Lepidium b	3	Tiny white	Rocky ledg	Low open A	rare.		Burnside Is	-22.094	114.5	GPS	1	N. Godfrey	NG 95/15	
Livistona al	4	Healthy, ne	Landform:	Buffel gras		Old seeds f	Site 2, Exm	-22.378	113.9	GPS	1	T. Gourlay,	SWO 11347	
Livistona al	4	Palm.	By dry cree		one of only		Cape Range	-22.369	113.9	MAN	3	J.M. Waldo	s.n.	
Phyllanthus	3	Shrub c. 70	Along smal				14 miles S	-22.444	114.1	AUTO	3	A.S. George		1275
Phyllanthus	3						Cape Range	-21.953	114	AUTO	4	A.S. George		2562
Phyllanthus	3						3 km N of F	-21.953	114	AUTO	4	D.W. Good		2261
Rhynchosia	4	Shrub, 50 c	Growing or				Yardie Cree	-22.316	113.9	AUTO	3	K.M. Allan		446
Rhynchosia	4	Perennial h	In limeston				Yardie Cree	-22.317	113.8	UNK	3	A.S. George		10297
Rhynchosia	4	Shrub 50 cr	Among lim				Yardie Cree	-22.316	113.9	AUTO	3	A.S. George		6638
Sclerolaena	1	Prostrate p	In quadrat	Acacia sync			Quadrat GI	-22.669	114.2	GPS	1	K. McCreer	GIR 16-14	
Stackhousia	3	A straggling	In red sand				Cape Range	-22.1	114	MAN	4	A.S. George		2585
Stackhousia	3	A straggling	In red sand				Cape Range	-22.1	114	MAN	4	A.S. George		2585
Stackhousia	3	A straggling	In red sand				Cape Range	-22.1	114	MAN	4	A.S. George		2585
Stackhousia	3						Cape Range	-21.95	114	MAN	3	A.S. George		1336
Stackhousia	3	Open twigg	Low limest	Grassland	abundant.		200 m S Mi	-22.154	113.9	MAN	0	G.J. Keighe		14410
Stackhousia	3						10.5 km alo	-21.953	114	AUTO	4	Y. Chadwic	s.n.	
Stackhousia	3	Scandent le	Stony creel	Acacia bive			On Shothol	-22.05	114.1	MAN	0	S.D. Hoppe		5083
Stackhousia	3	Woody her	Limestone	Hummock	occasional.		Cape Range	-21.98	114	AUTO	4	S. Osborne	EL 14	
Stackhousia	3	Spindly shr	Open rocky		few thousa		Walk track	-22.15	113.9	MAN	3	S.D. Hoppe		5073
Stackhousia	3	Wispy shru	Ridge line c	Growing up	scarce.		Cape Range	-22.233	113.8	MAN	0	S.D. Hoppe		5076
Stackhousia	3	Perennial,	Breakaway	Low shrubl	2 - 5 plants	Reproducti	Cape Range	-22.235	113.9	GPS	1	J. English	JE 66	
Stackhousia	3	Shrub 50 cr	Flood plain	Low trees.	21-50 plant	Also on Yar	Near Exmo	-22.05	114	MAN	3	J.E. Wajon		491
Stackhousia	3	Shrub to 1	Near top of	Low shrubs			2 km E of Y	-22.233	113.9	MAN	3	A.P. Brown		305
Stackhousia	3	Sparse, bra	Limestone	Low shrubl	infrequent.		Cape Range	-22.238	113.9	GPS	1	K.R.Thiele		3567
Stackhousia	3	Petals brigh	Creek bed i				Shothole C	-22.05	114.1	TOPO	3	G. Perry		838
Stackhousia	3	Clumped, l	On limesto	Amongst sp	common.		Pilgonamar	-22.183	113.8	MAN	3	K.F. Kennea		7307
Tephrosia s	2	Small pea 2	White ston				About 300	-21.978	114.1	AUTO	3	G. Marsh		81
Tephrosia s	2	Shrub, 0.2 r	Red / orang				Yardie Terr	-22.313	113.8	UNK	2	D. Sandow	s.n.	
Tinospora e	2	Large liane,	Area of roc	Commicarp			North West	-22.025	114.1	AUTO	3	M. Trudger	MET 12865	

Tinospora e	2	Creeper, cli	Crest of a li	Scattered E		Cape Range	-21.953	114	AUTO	3	M. Trudger	12866
Tinospora e	2					Cape Range	-21.953	114	MAN	3	W. Rogersc	300
Tinospora e	2	Annual clim	Plain. Brow	Low shrubl	one only.	Cape Range	-21.971	114	GPS	1	J. English	JE 0265
Tinospora e	2	Climer, flov	Low lying c	Acacia xiph	three plant	Learmonth	-22.242	114.1	GPS	1	J.M. Collins	ELA 45
Tinospora e	2	Climer, flov	Low lying c	Acacia xiph	three plant	Learmonth	-22.242	114.1	GPS	1	J.M. Collins	ELA 45
Tinospora e	2	Large liane,	Area of roc	Commicarp		North West	-22.025	114.1	AUTO	3	M. Trudger	MET 12865
Verticordia	2	Low spreac	Red sand o	Banksia ash	Abundance	Yardie Cree	-22.338	113.8	MAN	0	G.J. Keighe	273
Verticordia	2	Spreading s	On sand du	With shrub		Cape Range	-22.267	113.9	MAN	0	A.S. George	10285
Verticordia	2	Shrub 1.5 n	Red sandy s		Abundance	E of Sandy	-21.98	114	AUTO	4	B. Taylor	1

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 28/06/2017

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 114° 06' 02" E,22° 17' 48" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	3223	*Acacia arida*			
2.	3241	*Acacia bivenosa*			
3.	13500	*Acacia coriacea subsp. coriacea*			
4.	3356	*Acacia gregorii (Gregory's Wattle)*			
5.	3452	*Acacia murrayana (Sandplain Wattle)*			
6.	3506	*Acacia pyrifolia (Ranji Bush, Kandji)*			
7.	29015	*Acacia pyrifolia var. pyrifolia*			
8.	13078	*Acacia sclerosperma subsp. sclerosperma*			
9.	3549	*Acacia spathulifolia*			
10.	19456	*Acacia stellaticeps*			
11.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
12.	3606	*Acacia xiphophylla*			
13.	6486	*Aegialitis annulata (Club Mangrove)*			
14.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
15.	7822	*Angianthus acrohyalinus (Hook-leaf Angianthus)*			
16.	12063	*Aristida holathera var. holathera*			
17.	217	*Aristida nitidula (Flat-awned Threeawn)*			
18.	2456	*Atriplex elachophylla*			
19.	2463	*Atriplex isatidea (Coast Saltbush)*			
20.	2476	*Atriplex semilunaris (Annual Saltbush)*			
21.	6828	*Avicennia marina (White Mangrove)*			
22.	12714	*Brachychiton obtusilobus*		P4	
23.	35798	*Calothamnus borealis subsp. borealis*			
24.	7906	*Calotis plumulifera*			
25.	2976	*Capparis lasiantha (Split Jack, Balqarda)*			
26.	48291	*Capparis spinosa subsp. nummularia*			
27.	12073	*Cassytha aurea var. aurea*			
28.	11242	*Cassytha racemosa forma pilosa*			
29.	39680	*Ceriops australis*			
30.	47174	*Chrysocephalum apiculatum subsp. pilbarense*			
31.	17093	*Corymbia hamersleyana*			
32.	1286	*Corynotheca pungens*			
33.	3774	*Crotalaria cunninghamii (Green Birdflower, Bilbun)*			
34.	20179	*Crotalaria medicaginea var. neglecta*			
35.	7958	*Decazesia hecatocephala*			
36.	7164	*Dicladanthera forrestii*			
37.	2504	*Dysphania plantaginella*			
38.	357	*Enneapogon caerulescens (Limestone Grass)*			
39.	2513	*Eremophea spinosa*			
40.	16733	*Eremophila setacea*			
41.	23997	*Eremophila tietkensii*			
42.	4335	*Erodium cygnorum (Blue Heronsbill)*			
43.	5752	*Eucalyptus prominens*			
44.	15592	*Eucalyptus xerothermica*			
45.	35307	*Euphorbia australis var. australis*			
46.	42879	*Euphorbia trigonosperma*			
47.	10977	*Exocarpos aphyllus (Leafless Ballart)*			
48.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
49.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
50.	5209	*Frankenia pauciflora (Seaheath)*			
51.	1972	*Grevillea calcicola*		P3	
52.	2096	*Grevillea stenobotrya*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.	2784	*Gyrostemon ramulosus (Corkybark)*			
54.	16897	*Hakea stenophylla subsp. stenophylla*			
55.	23464	*Haloragis gossei var. inflata*			
56.	6641	*Ipomoea yardiensis (Yardie Morning Glory)*			
57.	29056	*Jasminum sp. Exmouth (G. Marsh 77)*			
58.	4061	*Lotus cruentus (Redflower Lotus)*			
59.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
60.	5887	*Melaleuca cardiophylla (Tangling Melaleuca)*			
61.	8105	*Millotia myosotidifolia*			
62.	2364	*Olax aurantia*			
63.	42024	*Olearia sp. Kennedy Range (G. Byrne 66)*			
64.	34997	*Peripleura arida*			
65.	45696	*Phyllanthus hamelinii (Shark Bay Phyllanthus)*			
66.	18260	*Pileanthus septentrionalis*			
67.	17816	*Pluchea ferdinandi-muelleri*			
68.	8168	*Pluchea rubelliflora*			
69.	6491	*Plumbago zeylanica (Native Plumbago)*			
70.	8192	*Pterocaulon sphacelatum (Apple Bush, Fruit Salad Plant)*			
71.	41506	*Ptilotus gaudichaudii subsp. gaudichaudii*			
72.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
73.	41001	*Ptilotus nobilis subsp. nobilis (Yellow Tails)*			
74.	2747	*Ptilotus obovatus (Cotton Bush)*			
75.	2766	*Ptilotus villosiflorus*			
76.	41063	*Quoya loxocarpa*			
77.	11240	*Rhagodia preissii subsp. obovata*			
78.	5295	*Rhizophora stylosa (Spotted-leaved Red Mangrove)*			
79.	13246	*Rhodanthe humboldtiana*			
80.	4191	*Rhynchosia minima (Rhynchosia)*			
81.	4706	*Sauropus crassifolius*			
82.	7643	*Scaevola sericophylla*			
83.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
84.	7648	*Scaevola tomentosa (Raggedleaf Fanflower)*			
85.	41646	*Schenkia clementii*			
86.	2628	*Sclerolaena recurvicuspis*			
87.	8213	*Senecio magnificus (Showy Groundsel)*			
88.	25883	*Senecio pinnatifolius var. pinnatifolius*			
89.	12280	*Senna artemisioides subsp. oligophylla*			
90.		*Sesbania sp.*			
91.	8223	*Sigesbeckia orientalis (Indian Weed)*	Y		
92.	3072	*Sisymbrium orientale (Indian Hedge Mustard)*	Y		
93.	8237	*Streptoglossa decurrens*			
94.	8238	*Streptoglossa liatroides*			
95.	3182	*Stylobasium spathulatum (Pebble Bush)*			
96.	2638	*Suaeda arbusculoides*			
97.	13592	*Swainsona calcicola*			
98.	4231	*Swainsona kingii*			
99.	4242	*Swainsona pterostylis*			
100.	17345	*Tinospora esiangkara*		P2	
101.	18072	*Tribulus suberosus*			
102.	679	*Triodia angusta*			
103.	704	*Triodia wiseana (Limestone Spinifex)*			
104.	706	*Triraphis mollis (Needle Grass)*			
105.	6081	*Verticordia forrestii (Forrest's Featherflower)*			
106.	4395	*Zygophyllum retivalve*			

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

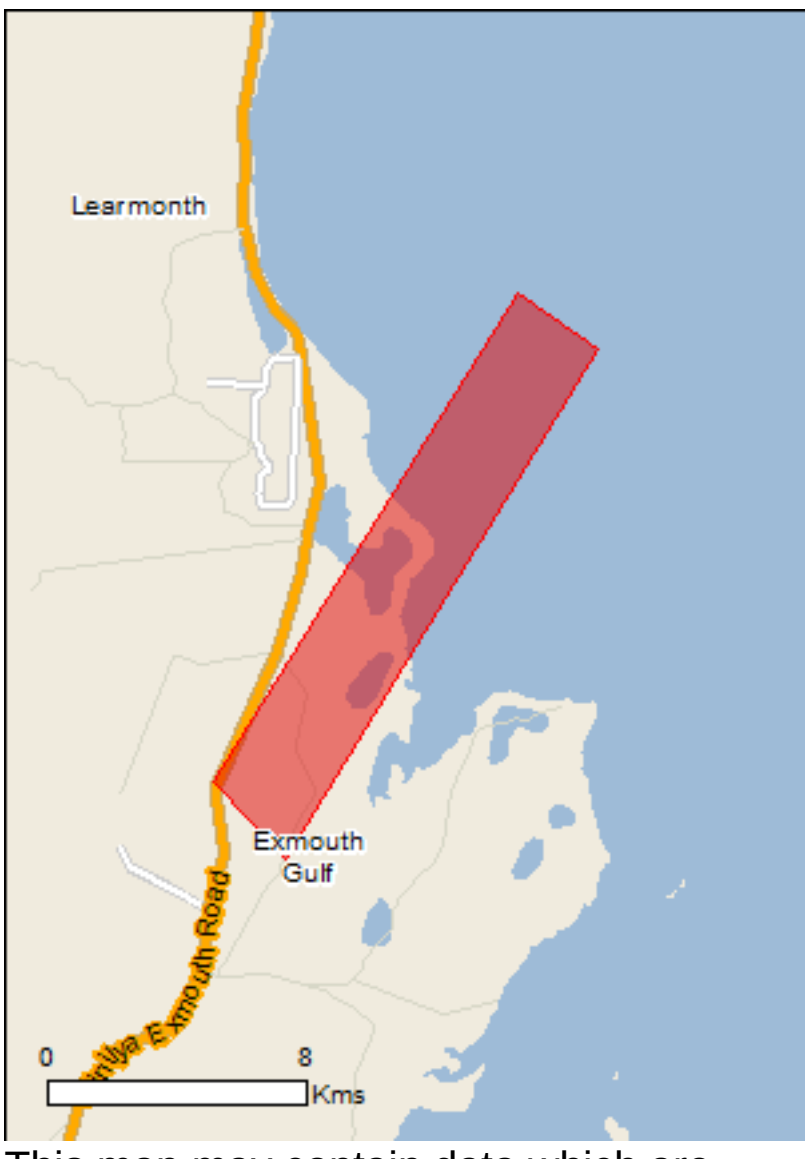
EPBC Act Protected Matters Report

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.

Report created: 22/02/17 13:35:49



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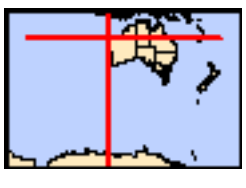

Summary

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:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	24
Listed Migratory Species:	33

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:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	64
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may 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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [331]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Mororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding 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 likely to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	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
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat may occur within area
Migratory Marine Species		

Name	Threatened	Type of Presence
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 likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	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 known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Defence - EXMOUTH NAVAL HF RECEIVING STATION (H/F Receiving Station, Learmonth, WA)
Defence - LEARMONTH TRANSMITTING STATION

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		
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

Name	Threatened	Type of Presence
		area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		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
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		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
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		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 kuda Spotted Seahorse, Yellow Seahorse [66237]		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
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		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
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		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
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour 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

Name	Threatened	Type of Presence
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
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding 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
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may 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
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		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 aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species

Name	Status	Type of Presence
		habitat may occur within area

Extra Information

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Cape Range Subterranean Waterways	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

-22.19801 114.155674,-22.212314 114.178334,-22.34384 114.091473,-22.32415 114.071217,-22.19801 114.155674,-22.19801 114.155674

Acknowledgements

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

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

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

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

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APPENDIX F

Flora Likelihood Assessment

Assessment of the Likely Occurrence of DRF and Priority Flora (as per DPaW and EPBC Database Searches) in the Survey Area

[1]Closest record to Survey Area based on DPaW 2015.Likely = Suitable habitat present and records less than 5 km from the Survey Area, Possible = Suitable habitat present and records between 5 km and 10 km from the Survey Area, and Unlikely = No suitable habitat present and/or records greater than 10 km from the Survey Area. En = Listed as Endangered under the EBPC Act, Vu = Listed as Vulnerable under the EBPC, Ce= Critically Endangered under the EBPC Act, P = Listed as Priority by the DPaW DRF = Declared Rare Flora as listed by the State.

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW	-	P1	*Cyperus victoriensis*	Along creeks.	88 km	No	Unlikely
DPaW	-	P1	*Sclerolaena stylosa*	Orange sandy clay.	35 km	Yes	Unlikely
DPaW	-	P2	*Abutilon sp. Quobba*	Brown clayey sand.	Unknown	No	Unknown
DPaW	-	P2	*Acacia ryaniana*	White or red sand. Coastal sand dunes.	26 km	Yes	Unlikely
DPaW	-	P2	*Acanthocarpus rupestris*	Red sand, limestone.	29 km	Yes	Unlikely
DPaW	-	P2	*Crinum flaccidum*	Loam, clay, sandstone. Swamps, creeks.	22 km	No	Unlikely
DPaW	-	P2	*Daviesia pleurophylla*	Sand dunes.	21 km	Yes	Unlikely
DPaW	-	P2	*Eremophila occidens*	Orange/brown sand. Limestone ranges, dunes.	30 km	No	Unlikely
DPaW	-	P2	*Harnieria kempeana subsp. rhadinophylla*	Calcareous loam. Amongst limestone rocks, creek banks.	32 km	No	Unlikely
DPaW	-	P2	*Tephrosia sp. North West Cape*	Red/brown soil.	Unknown	Yes	Unknown
DPaW NatureMap	-	P2	*Tinospora esiangkara*	Pebbly orange-brown calcareous loam. Limestone outcrops or ridges, near creek bank.	17 km	No	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW	-	P2	*Verticordia serotina*	Red sand. Sand dunes.	22 km	Yes	Unlikely
DPaW	-	P3	*Acacia alexandri*	Limestone. Stony creeks, steep rocky slopes.	16 km	No	Unlikely
DPaW	-	P3	*Acacia startii*	Calcareous loam with limestone pebbles. Stony hills and water courses.	15 km	No	Unlikely
DPaW	-	P3	*Carpobrotus* sp. Thevenard Island	Coarse white sand. Dune tops, disturbed areas.	Unknown	No	Unlikely
DPaW	-	P3	*Corchorus congener*	Sand, red sandy loam with limestone. Sand dunes, plains.	6 km	Yes	Recorded in Survey Area
DPaW	-	P3	*Dysphania congestiflora*	Saline flood plain.	120 km	Yes	Unlikely
DPaW	-	P3	*Eremophila forrestii* subsp. *capensis*	Brown rocky soils, limestone. Ridges.	26 km	No	Unlikely
DPaW NatureMap	-	P3	*Grevillea calcicola*	Limestone hilltops.	12 km	No	Unlikely
DPaW	-	P3	*Lepidium biplicatum*	Coastal regions.	70 km	Yes	Unlikely
DPaW	-	P3	*Phyllanthus fuernrohrii*	Sand over Limestone.	6 km	No	Possible
DPaW	-	P3	*Stackhousia umbellata*	Sandy soils on limestone.	25 km	No	Unlikely
DPaW NatureMap	-	P4	*Brachychiton obtusilobus*	Skeletal soils. Rocky limestone ranges, gorges, occasionally sandplains.	3 km	Yes	Possible

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW	-	P4	*Eremophila youngii* subsp. *lepidota*	Stony red sandy loam. Flat plains, floodplains, sometimes semi-saline, clay flats.	39 km	Yes	Unlikely
DPaW	-	P4	*Livistona alfredii*	Edges of permanent pools.	17 km	No	Unlikely
DPaW	-	P4	*Rhynchosia bungarensis*	Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall.	17 km	No	Unlikely

APPENDIX G

Flora Inventory

FAMILY	NAME
Amaranthaceae	**Aerva javanica*
	Ptilotus obovatus
Asparagaceae	*Acanthocarpus preissii*
Asteraceae	*Chrysocephalum apiculatum* subsp. *pilbarense*
	Chrysocephalum apiculatum subsp. *racemosum*
	Olearia sp. Kennedy Range (G. Byrne 66)
	Peripleura arida
	Pluchea ferdinandi-muelleri
	Pterocaulon sphacelatum
	Streptoglossa sp.
Boraginaceae	*Heliotropium glanduliferum*
	Heliotropium pachyphyllum
Chenopodiaceae	*Maireana* sp.
	Salsola australis
	Tecticornia ?indica
	Tecticornia sp.
Convolvulaceae	*Bonamia erecta*
	Ipomoea costata
	Ipomoea sp.
Cucurbitaceae	*Cucumis* sp.
Euphorbiaceae	*Euphorbia drummondii*
Fabaceae	**Vachellia farnesiana*
	Acacia bivenosa
	Acacia coriacea
	Acacia gregorii
	Acacia sclerosperma subsp. *sclerosperma*
	Acacia stellaticeps
	Acacia synchronicia
	Acacia tetragonocarpa
	Cullen lachnostachys
	Indigofera chamaeclada
	Indigofera chamaeclada subsp. *Pubens*
	Labichea cassioides
	Rhynchosia minima

FAMILY	NAME
	Senna artemisioides subsp. *oligophylla*
	Senna glutinosa
	Senna notabilis
Frankeniaceae	*Frankenia pauciflora*
Goodeniaceae	*Dampiera incana* var. *incana*
	Goodenia tenuiloba
	Scaevola cunninghamii
	Scaevola sericophylla
Lamiaceae	*Pityrodia loxocarpa*
	Quoya loxocarpa
Lauraceae	*Cassytha racemosa*
Malvaceae	*Abutilon cunninghamii*
	Abutilon sp.
	Corchorus congener (P3)
	Hannafordia quadrivalvis subsp. *recurva*
	Malvaceae sp.
	Sida rohlenae subsp. *rohlenae*
Myrtaceae	*Corymbia opaca*
	Eucalyptus sp.
	Melaleuca cardiophylla
	Myrtaceae sp.
	Pileanthus septentrionalis
Phyllanthaceae	*Phyllanthus* sp. Coastal North West (J.Z. Weber 4919)
Plantaginaceae	*Stemodia* sp. Onslow (A.A. Mitchell 76/148)
Plumbaginaceae	*Muellerolimon salicorniaceum*
Poaceae	**Cenchrus ciliaris*
	Eragrostis eriopoda
	Eriachne obtusa
	Spinifex longifolius
	Triodia epactia
	Triodia schinzii
Proteaceae	*Hakea stenophylla*
Santalaceae	*Santalum lanceolatum*
Sapindaceae	*Alectryon oleifolius* subsp. *oleifolius*
	Diplopeltis intermedia var. *intermedia*

FAMILY	NAME
Scrophulariaceae	*Eremophila longifolia*
	Eremophila setacea
Solanaceae	*Solanum lasiophyllum*
Surianaceae	*Stylobasium spathulatum*
Thymelaeaceae	*Pimelea ammocharis*

APPENDIX H

Species Matrix

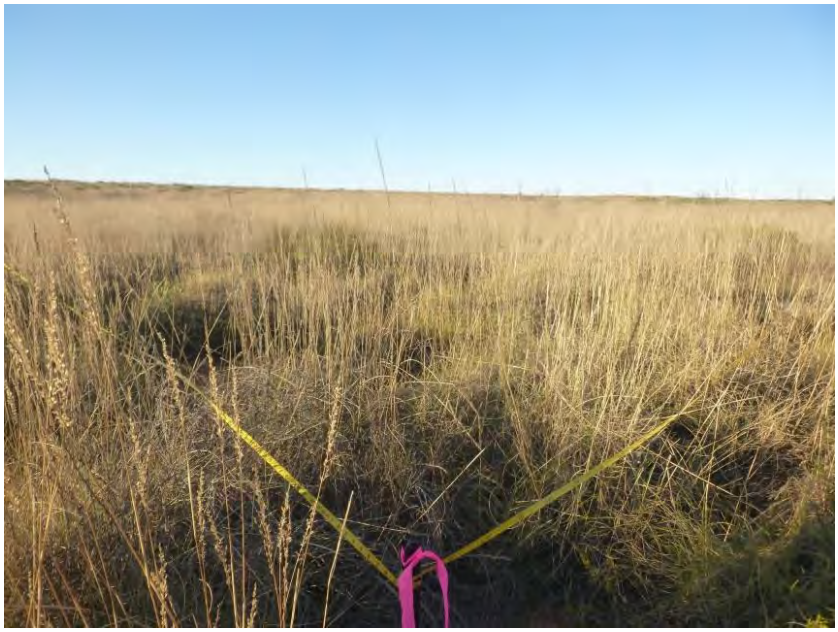
NAME	OP	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q25	Q26	Q27	Q28	Q29	Q30	Q31
Abutilon cunninghamii																								*						
Abutilon sp.																					*			*						
Acacia bivenosa													*	*	*	*		*												
Acacia coriacea	*			*	*		*							*	*					*	*	*		*						
Acacia gregorii		*	*			*	*	*											*	*		*	*		*			*		
Acacia sclerosperma	*			*																										
Acacia sclerosperma subsp. sclerosperma	*				*															*										
Acacia stellaticeps	*						*			*					*				*							*	*			
Acacia synchronicia		*																												
Acacia tetragonophylla				*										*							*	*								
Acanthocarpus preissii			*		*	*		*									*						*		*					*
*Aerva javanica**														*										*						
Alectryon oleifolius subsp. oleifolius																											*			
Bonamia erecta		*																												
Cassytha racemosa			*	*		*	*									*	*						*		*					
*Cenchrus ciliaris**					*				*	*			*	*			*	*		*	*	*		*			*			
Chrysocephalum apiculatum subsp. racemosum	*																													*
Corchorus congener (P3)	*		*	*	*	*		*		*			*			*		*		*	*	*	*	*			*			
Corymbia opaca																								*						
Cucumis sp.																					*									
Cullen lachnostachys	*	*	*							*			*							*	*	*		*						
Dampiera incana						*	*	*										*	*	*										
Dampiera incana var. incana	*																													
Diplopeltis intermedia var. intermedia																									*			*		
Eragrostis eriopoda																						*								
Eremophila longifolia	*																													
Eremophila setacea																											*			
Eriachne obtusa		*	*	*		*	*	*		*								*	*	*		*	*		*			*		
Euphorbia drummondii						*																								
Frankenia pauciflora	*								*		*	*																		
Hakea stenophylla							*																					*		
Hannafordia quadrivalvis subsp. recurva	*				*	*	*																							
Heliotropium glanduliferum																						*						*		
Indigofera chamaeclada	*		*	*			*	*									*	*				*								
Ipomoea costata	*																													
Ipomoea sp.										*																				
Labichea cassioides	*						*																							
Maireana sp.															*															
Malvaceae sp.					*																							*		
Melaleuca cardiophylla	*							*											*				*							*

NAME	OP	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q25	Q26	Q27	Q28	Q29	Q30	Q31
Peripleura arida									*								*													
Phyllanthus sp. Coastal North West			*	*	*																*	*	*							
Pileanthus septentrionalis																								*		*	*	*		
Pimelea ammocharis	*																													
Pityrodia loxocarpa	*																													
Pluchea ferdinandi-muelleri	*							*									*	*												
Pterocaulon sphacelatum			*							*			*																	
Ptilotus obovatus			*			*																								
Quoya loxocarpa																										*				
Rhynchosia minima				*				*									*	*												*
Salsola australis														*	*															
Santalum lanceolatum																									*					
Scaevola cunninghamii																												*	*	
Scaevola sericophylla	*						*			*			*	*						*					*	*		*	*	
Senna artemisioides subsp. oligophylla													*							*				*						
Senna glutinosa	*																													
Senna notabilis	*																													
Sida rohlenae subsp. rohlenae																					*									
Solanum lasiophyllum		*	*		*	*	*			*			*			*		*		*				*						
Spinifex longifolius														*	*															
Stemodia sp. Onslow (A.A. Mitchell 76/148)									*								*	*												
Streptoglossa sp.			*																											
Stylobasium spathulatum	*																					*								
Tecticornia sp.										*	*	*																		
Triodia epactia		*	*	*	*	*	*	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Triodia schinzii	*																													
*Vachellia farnesiana**	*																													

APPENDIX I

Site Sheets

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ1

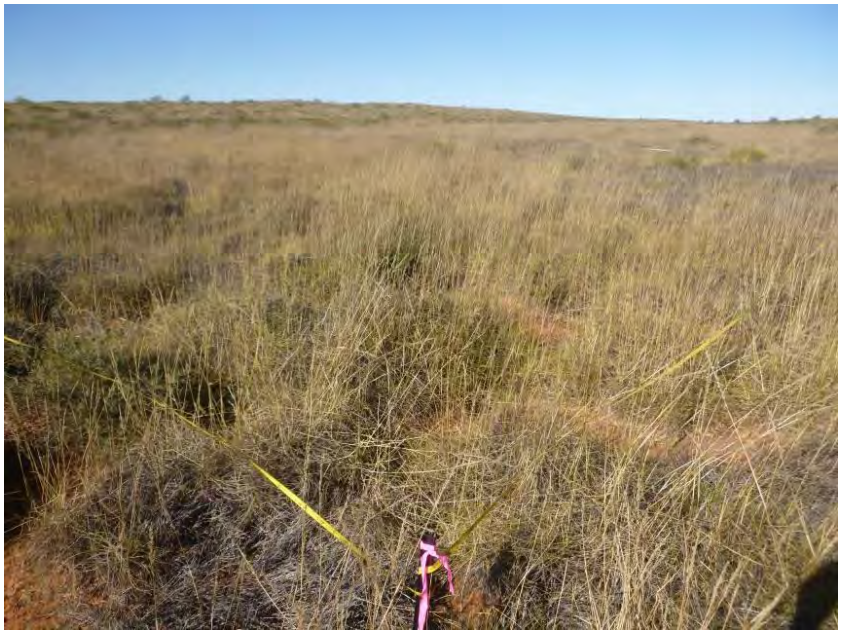


Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 198899 **mE** 7526357 **mN** 114.076783 **E** -22.342275 **S**
Habitat Undulating plain between sand dunes
Soil Orange red sand
Vegetation *Acacia gregorii* low open shrubland over *Trioida epactia* hummock grassland with *Eriachne obtusa* isolated grasses
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Disturbance: Sheep grazing and tracks
Bareground: 15%

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	+	60-80
Acacia synchronicia	4	120
Bonamia erecta	+	40
Cullen lachnostachys	+	300
Eriachne obtusa	.5	40
Solanum lasiophyllum	+	70
Triodia epactia	80	80

Subsea7 Learmonth Flora and Vegetation Assessment
Site SUBQ2



Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 199229 **mE** 7527010 **mN** 114.080106 **E** -22.336442 **S**
Habitat Undulating plain between sand dunes
Soil Orange red sand
Vegetation *Acacia gregorii* shrubland with *Acanthocarpus preissii* isolated shrubs over *Triodia epactia* hummock grassland with *Eriachne obtusa* isolated grasses
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Disturbance: Grazing by sheep and tracks

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	7	80
Acanthocarpus preissii	1	40
Cassytha racemosa	+	c
Corchorus congener	+	30
Cullen lachnostachys	+	10
Eriachne obtusa	.5	40
Indigofera chamaeclada	.5	10
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	.5	70
Pterocaulon sphacelatum	+	50
Ptilotus obovatus	+	40
Solanum lasiophyllum	+	60
Streptoglossa sp.		
Triodia epactia	80	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ3

Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 199627 **mE** 7527807 **mN** 114.084116 **E** -22.329320 **S**
Soil Orange red sand
Vegetation *Acacia coriacea* and *Acacia tetragonophylla* low open shrubland over *Triodia epactia* hummock grassland over *Eriachne obtusa* isolated grasses
Veg Condition (VG)
Fire Age Very Old (>12)

SPECIES LIST:

Name	Cover	Height
Acacia coriacea	5	250
Acacia sclerosperma		120
Acacia tetragonophylla	4	170
Cassytha racemosa	+	c
Corchorus congener	+	50
Eriachne obtusa	5	50
Indigofera chamaeclada	+	20
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	+	40
Rhynchosia minima	2	c
Triodia epactia	60	80

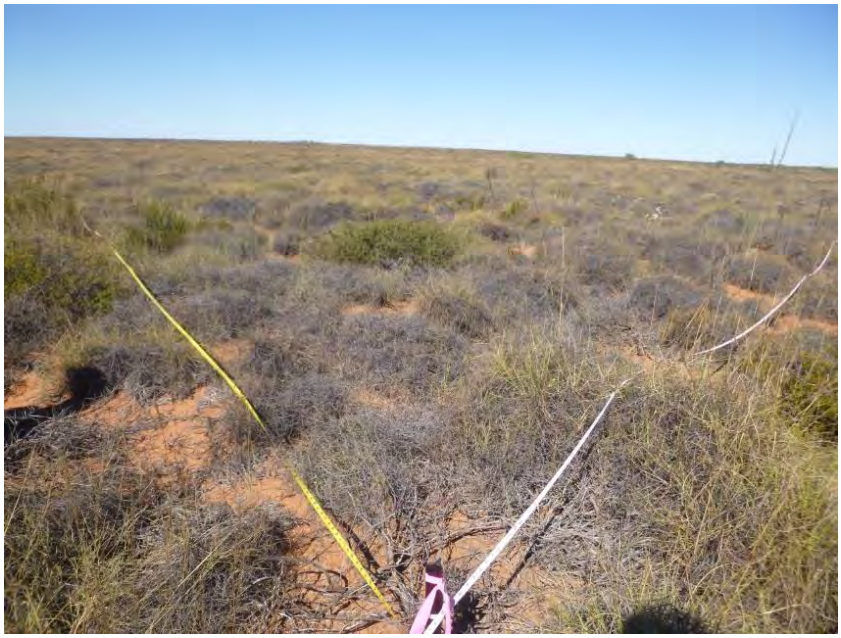
Subsea7, Learmonth Flora & Vegetation Assessment
Site SUBQ4

Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 199956 **mE** 7528585 **mN** 114.087452 **E** -22.322358 **S**
Habitat Plain
Soil Orange sand
Vegetation *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia coriacea* low open shrubland over *Triodia epactia* closed grassland
Veg Condition (G)
Fire Age Very Old (>12)
Notes Disturbance: Weeds (Buffel grass), Tracks and Grazing (sheep)

SPECIES LIST:

Name	Cover	Height
Acacia coriacea	5	250
Acacia sclerosperma subsp. *sclerosperma*	25	150
Acanthocarpus preissii	+	40
*Cenchrus ciliaris**	20	40
Corchorus congener	+	100
Hannafordia quadrivalvis subsp. *recurva*	+	60
Malvaceae sp.	+	
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	+	
Solanum lasiophyllum	+	50
Triodia epactia	65	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ5



Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 200335 **mE** 7529030 **mN** 114.091211 **E** -22.318409 **S**
Soil Orange red sand
Vegetation *Acacia gregorii* low open shrubland over *Triodia epactia* and *Eriachne obtusa* grassland
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Disturbance: Tracks
Bareground: 20%

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	10	50
Acanthocarpus preissii	3	40
Cassytha racemosa	5	c
Corchorus congener	+	40
Dampiera incana	1	60
Eriachne obtusa	10	40
Euphorbia drummondii	+	10
Hannafordia quadrivalvis subsp. *recurva*	5	30
Ptilotus obovatus	+	40
Solanum lasiophyllum	1	40
Triodia epactia	60	80

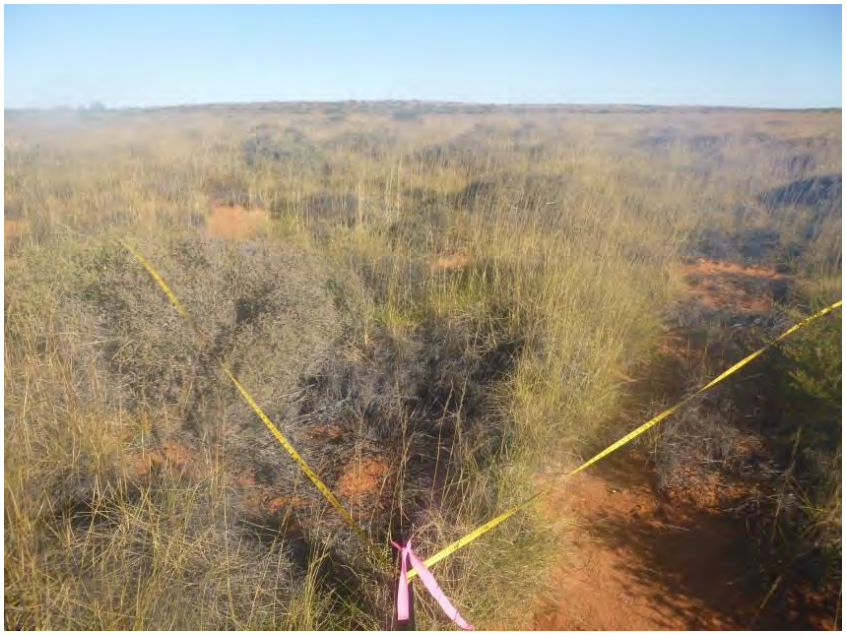
Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ6

Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201636 **mE** 7531087 **mN** 114.104210 **E** -22.300076 **S**
Soil Orange red sand
Vegetation *Acacia stellaticeps* and *Scaevola sericophylla* open shrubland over *Triodia epactia* and *Eriachne obtusa* grassland
Veg Condition (VG)
Notes Disturbance: Grazing and tracks
Bareground: 15%

SPECIES LIST:

Name	Cover	Height
Acacia coriacea		
Acacia gregorii	3	
Acacia stellaticeps	20	100
Cassytha racemosa	+	c
Dampiera incana	+	
Eriachne obtusa	20	40
Hakea stenophylla	5	120
Hannafordia quadrivalvis subsp. *recurva*	+	50
Indigofera chamaeclada subsp. *pubens*	+	
Labichea cassioides	2	120
Scaevola sericophylla	+	100
Solanum lasiophyllum	+	50
Triodia epactia	30	80

Subsea7 Learmonth Flora and Vegetation Assessment
Site SUBQ7



Described by SF and AD **Date** 23/05/2017 **Type** Q 20 x 20m
MGA Zone 50 202270 **mE** 7532122 **mN** 114.110550 **E** -22.290847 **S**
Habitat Depression
Soil Orange red sand
Vegetation *Melaleuca cardiophylla* low open shrubland over *Triodia epactia* closed grassland
Veg Condition (EX) (VG)
Notes Disturbance: Grazing (sheep)

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	5	50
Acanthocarpus preissii	+	60
Corchorus congener	+	50
Dampiera incana	1	50
Eriachne obtusa	3	40
Indigofera chamaeclada	.5	30
Melaleuca cardiophylla	40	60
Pluchea ferdinandi-muelleri	.5	40
Rhynchosia minima		
Triodia epactia	40	80

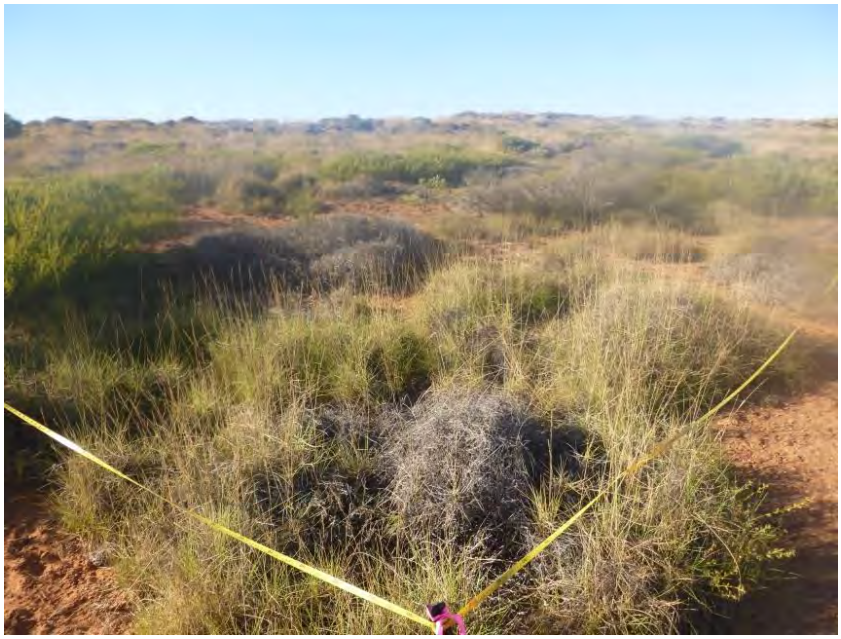
Subsea7, Learmonth Flora and Vegetation Asessment
Site SUBQ8

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 200799 **mE** 7535383 **mN** 114.096896 **E** -22.261170 **S**
Vegetation *Stemodia* sp. Onslow low open shrubland over *Triodia epactia* closed grassland
Veg Condition (P)
Notes Disturbance: Vegetation grazed and Buffel grass
Bareground: 50% Leaf Litter: %

SPECIES LIST:

Name	Cover	Height
*Cenchrus ciliaris**	8	20
Frankenia pauciflora	1	30
Peripleura arida	1	15
Stemodia sp. Onslow (A.A. Mitchell 76/148)	8	20
Triodia epactia	30	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ9



Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201195 **mE** 7535309 **mN** 114.100720 **E** -22.261906 **S**
Habitat Sand dune
Soil Orange red sand
Vegetation *Acacia stellaticeps* and *Scaevola sericophylla* low open shrubland over *Triodia epactia* open grassland
Veg Condition (P)
Notes Disturbance: Sheep grazing, tracks and Buffel grass

SPECIES LIST:

Name	Cover	Height
Acacia stellaticeps	25	100
*Cenchrus ciliaris**	7	20
Corchorus congener	+	40
Cullen lachnostachys	1	80
Eriachne obtusa	5	40
Ipomoea sp.	+	c
Pterocaulon sphacelatum	+	20
Scaevola sericophylla	+	60
Solanum lasiophyllum	+	50
Tecticornia sp.	+	60
Triodia epactia	25	80

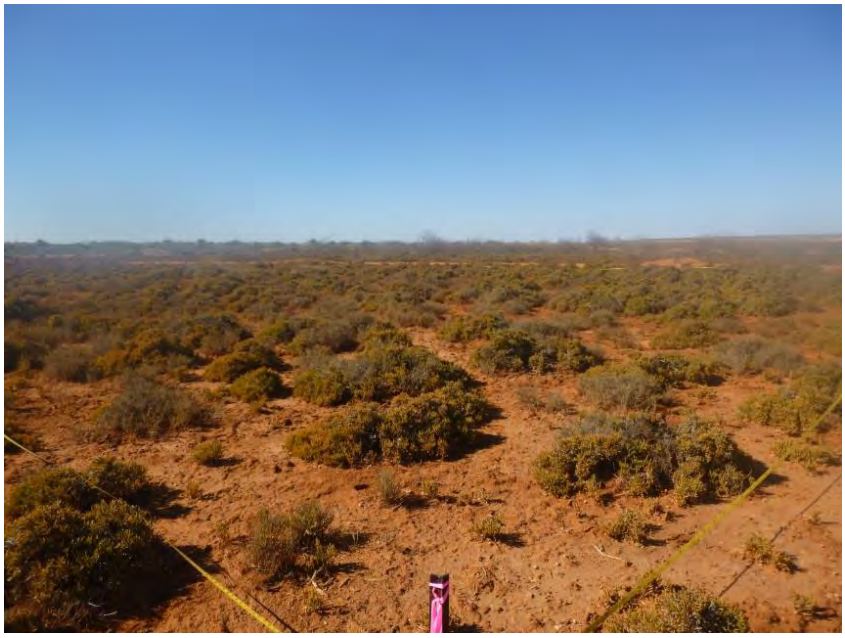
Subsea7, Learmonth Flora and Vegetation Assesment
Site SUBQ10

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201105 **mE** 7535417 **mN** 114.099868 **E** -22.260916 **S**
Habitat Saline flat
Soil Orange sand
Vegetation *Tecitcornia ?indica* and *Frankenia pauciflora* low shrubland on saline flat
Veg Condition (P)
Notes Disturbance: Sheep grazing (droppings in quad)
Bareground: 60%

SPECIES LIST:

Name	Cover	Height
Frankenia pauciflora	15	30
Muellerolimon salicorniaceum	10	30
Tecticornia ? indica	15	30

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ11



Described by SF and AD **Date** 24/05/2017 **Type** Q
MGA Zone 50 201730 **mE** 7535472 **mN** 114.105937 **E** -22.260528 **S**
Habitat Saline flat
Soil Orange sandy clay
Vegetation *Tecticornia ?indica* and *Frankenia pauciflora* low shrubland
Veg Condition (G)
Fire Age Very Old (>12)
Notes Disturbance: Sheep grazing

SPECIES LIST:

Name	Cover	Height
Frankenia pauciflora	8	30
Tecticornia ?indica.	40	40
Muellerolimon salicorniaceum	12	30

Subsea7 Learmonth Flora and Vegetation Assessment
Site SUBQ12

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201923 **mE** 7535509 **mN** 114.107814 **E** -22.260227 **S**
Habitat Hill rocky outcrop
Soil Orange sand
Vegetation *Acacia bivenosa* open shrubland over *Scaevola sericophylla* low open shrubland over *Triodia epactia* hummock grassland
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Disturbance: Weeds, tracks and grazing
SPECIES LIST:

Name	Cover	Height
Acacia bivenosa	10	150
*Cenchrus ciliaris**	2	30
Corchorus congener	+	15
Cullen lachnostachys	+	80
Pterocaulon sphacelatum	+	
Scaevola sericophylla		60
Senna artemisioides subsp. *oligophylla*	+	
Solanum lasiophyllum	1	40
Triodia epactia	25	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ13

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 204339 **mE** 7535568 **mN** 114.131245 **E** -22.260110 **S**
Habitat Coastline
Soil Grey white sand
Vegetation *Acacia bivenosa* and *Acacia coriacea* low open shrubland over *Spinifex longifolius* and *Triodia epactia* open grassland
Veg Condition (G)
Fire Age Very Old (>12)
Notes Disturbance: 4WD tracks, weeds, litter and sheep grazing

SPECIES LIST:

Name	Cover	Height
Acacia bivenosa	1	30-100
Acacia coriacea	2	120
Acacia tetragonophylla	+	10
Aerva javanica	+	50
*Cenchrus ciliaris**	+	20
Salsola australis	+	40
Scaevola sericophylla	+	30
Spinifex longifolius	5	100
Triodia epactia	18	50

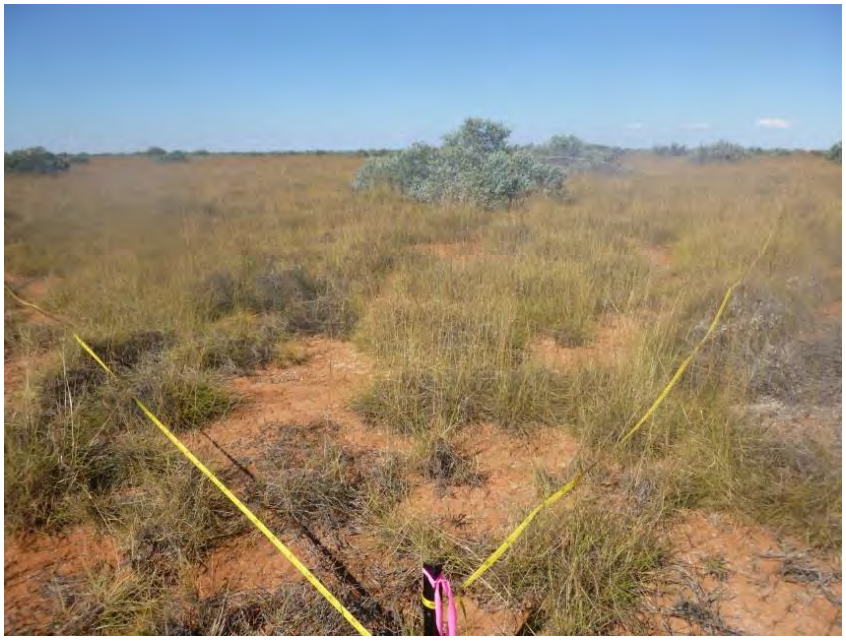
Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ14

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
Location Along coastline
MGA Zone 50 204022 **mE** 7535822 **mN** 114.128219 **E** -22.257764 **S**
Habitat Along coastline - bottom of sand dune
Soil white grey sand
Vegetation *Acacia bivenosa* and *Acacia coriacea* low open shrubland over *Spinifex longifolius* and *Triodia epactia* open grasssland
Veg Condition (G)
Fire Age Very Old (>12)
Notes Disturbance: litter and 4WD tracks
Bareground: 50%

SPECIES LIST:

Name	Cover	Height
Acacia bivenosa	.5	40
Acacia coriacea	4	120
Acacia stellaticeps	+	40
Maireana sp.	+	15
Salsola australis	.5	40
Spinifex longifolius	15	80
Triodia epactia	1	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ15



Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 203754 **mE** 7535042 **mN** 114.125477 **E** -22.264756 **S**
Habitat Plain
Soil Orange red sand
Vegetation *Acacia bivenosa* low shrubland over *Triodia epactia* hummock grassland
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Bareground: 15%

SPECIES LIST:

Name	Cover	Height
Acacia bivenosa	20	280
Cassytha racemosa	+	c
Corchorus congener	+	20
Solanum lasiophyllum	+	60
Triodia epactia	65	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ16

Described by SF and AD **Date** 24/05/2017 **Type** Q 20 x 20m
MGA Zone 50 202976 **mE** 7533285 **mN** 114.117610 **E** -22.280475 **S**
Habitat Plain between dunes
Soil Orange red sand
Vegetation *Stemodia* sp. Onslow and *Acanthocarpus preissii* low open shrubland over *Triodia epactia* and *Cenchrus cilaris* grassland
Veg Condition (EX) (VG)
Fire Age Very Old (>12)

SPECIES LIST:

Name	Cover	Height
Acanthocarpus preissii	15	30
Cassytha racemosa	+	c
*Cenchrus ciliaris**	8	20
Indigofera chamaeclada	+	15
Peripleura arida	+	15
Pluchea ferdinandi-muelleri	+	60
Rhynchosia minima	+	15
Stemodia sp. Onslow (A.A. Mitchell 76/148)	8	20
Triodia epactia	60	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ17

Described by SF and AD **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 202497 **mE** 7532499 **mN** 114.112821 **E** -22.287485 **S**
Habitat Plain between sand dunes
Soil Orange red sand
Vegetation *Acacia bivenosa* shrubland over *Triodia epactia* grassland
Veg Condition (G)
Fire Age Very Old (>12)
Notes Disturbance: Weeds (Buffel grass) and sheep grazing

SPECIES LIST:

Name	Cover	Height
Acacia bivenosa	20	200
*Cenchrus ciliaris**	3	20
Corchorus congener	+	30
Dampiera incana	+	
Eriachne obtusa	7	40
Indigofera chamaeclada	+	20
Pluchea ferdinandi-muelleri	5	60
Rhynchosia minima	2	c
Solanum lasiophyllum	+	50
Stemodia sp. Onslow (A.A. Mitchell 76/148)	10	70
Triodia epactia	25	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ18

Described by SF and AD **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201938 **mE** 7531490 **mN** 114.107213 **E** -22.296492 **S**
Habitat Plain between sand dunes
Soil Orange red sand
Vegetation *Melaleuca cardiophylla* low shrubland over *Triodia epactia* grassland
Veg Condition (VG)
Fire Age Very Old (>12)
Notes Disturbance: Sheep grazing
Bareground: 15% Leave Litter: 5%

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	1	100
Acacia stellaticeps	2	80
Dampiera incana	.5	30
Eriachne obtusa	4	30
Melaleuca cardiophylla	40	70
Triodia epactia	34	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ19

Described by SF and AD **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 201459 **mE** 7530835 **mN** 114.102447 **E** -22.302319 **S**
Habitat Sand dune
Soil Orange red sand
Vegetation *Acacia sclerosperma* subsp. *sclerosperma* shrubland over *Triodia epactia* closed grassland.
Veg Condition (VG)
Notes Disturbance: Grazing by sheep, mostly on Buffel grass
Bareground: 25% Leaf Litter: 10%

SPECIES LIST:

Name	Cover	Height
Acacia coriacea	+	80
Acacia gregorii	4	50
Acacia sclerosperma subsp. *sclerosperma*	20	200
*Cenchrus ciliaris**	4	20
Corchorus congener	+	30
Cullen lachnostachys	+	50
Dampiera incana	+	30
Eriachne obtusa	15	40
Scaevola sericophylla	3	50
Senna artemisioides subsp. *oligophylla*	2	70
Solanum lasiophyllum	+	60
Triodia epactia	20	80

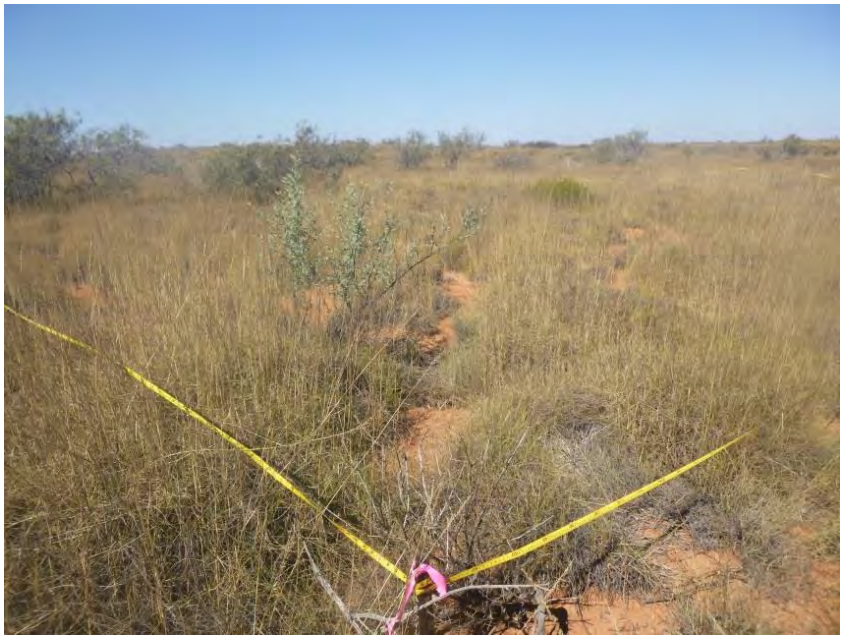
Subsea7 Learmonth Flora and Vegetation Assessment
Site SUBQ20

Described by SF and AD **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 199258 **mE** 7527551 **mN** 114.080489 **E** -22.331566 **S**
Habitat Drainage line
Soil Orange sand
Vegetation *Cullen lachnostachys* and *Acacia coriacea* shrubland over *Sida rohlenae* subsp. *rohlenae* low shrubland over *Triodia epactia* and *Cenchrus ciliaris** grassland
Veg Condition (D)
Fire Age Very Old (>12)
Notes Disturbance: Weeds/ grazing
Bareground: 10% Leaf Litter: 15%

SPECIES LIST:

Name	Cover	Height
Abutilon sp.	.5	80
Acacia coriacea	15	300
Acacia tetragonophylla		
*Cenchrus ciliaris**	25	40
Corchorus congener	+	50
Cucumis sp.	+	c
Cullen lachnostachys	50	280
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	+	40
Sida rohlenae subsp. *rohlenae*	5	100
Triodia epactia	5	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ21



Described by SF **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 199535 **mE** 7527528 **mN** 114.083171 **E** -22.331822 **S**
Habitat Plain between dunes
Soil Orange sand
Vegetation *Acacia coriacea* and *Acacia tetragonophylla* low open shrubland over *Triodia epactia* hummock grassland
Veg Condition (G)
Notes Disturbance: Weeds
Bareground: 15 %

SPECIES LIST:

Name	Cover	Height
Acacia coriacea	20	300
Acacia gregorii	2	100
Acacia tetragonophylla	5	100
*Cenchrus ciliaris**	3	40
Corchorus congener	+	50
Cullen lachnostachys	+	40
Eragrostis eriopoda	+	30
Eriachne obtusa	5	
Heliotropium glanduliferum		
Indigofera chamaeclada	1	20
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	+	60
Stylobasium spathulatum	.5	150
Triodia epactia	50	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site SUBQ22

Described by SF and AD **Date** 25/05/2017 **Type** Q 20 x 20m
MGA Zone 50 198946 **mE** 7526676 **mN** 114.077299 **E** -22.339406 **S**
Habitat Plain between dunes
Soil Orange red sand
Vegetation *Acacia gregorii* low open shrubland over *Triodia epactia* hummock grassland
Veg Condition (VG)
Notes Disturbance: Grazing (Sheep) and vehicle tracks
Bareground: 15% Leave Litter: 5%

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	15	60
Acanthocarpus preissii	5	50
Cassytha racemosa	+	c
Corchorus congener	+	30
Eriachne obtusa	5	40
Melaleuca cardiophylla	5	60
Phyllanthus sp. Coastal North West (J.Z. Weber 4919)	+	40
Triodia epactia	50	80

Subsea7, Learmonth Flora and Vegetation Assessment
Site QE25

Described by SF **Date** 21/09/2017 **Type** Q 20m x 20m
Location Exmouth
MGA Zone 50 199411 **mE** 7527749 **mN** 114.082010 **E** -22.329806 **S**
Habitat Coastal vegetation
Soil Sand, Soft Clay, beige, orange
Vegetation *Acacia coriacea* river veg total pfc 40%
Veg Condition Poor
Fire Age unknown
Notes Bareground 60%, Leaf Litter 20%, Logs 2%
Disturbance Type: Heavy grazing by sheep, weeds

SPECIES LIST:

Name	Cover	Height
Abutilon cunninghamii	0.1%	1.2m
Abutilon sp.	0.1%	0.6m
Acacia coriacea	20%	3m
*Aerva javanica**	0.1%	0.5m
*Cenchrus ciliaris**	35%	0.5m
Corchorus congener	0.1%	0.3m
Corymbia opaca	-	6m
Cullen lachnostachys	10%	3m
Pileanthus septentrionalis	1%	0.4m
Senna artemisioides subsp. *oligophylla*	1%	1.8m
Solanum lasiophyllum	0.1%	0.5m
Triodia epactia	4%	0.3m

Subsea7, Learmonth Flora and Vegetation Assessment
Site QE26

Described by SF **Date** 21/09/2017 **Type** Q 20m x 20m
Location Exmouth
MGA Zone 50 198634 **mE** 7526860 **mN** 114.074308 **E** -22.337691 **S**
Habitat Coastal Vegetation
Soil Clay, sand, soft clay, beige, orange
Vegetation *Acacia gregorii* over *Triodia epactia*
Veg Condition Very Good
Fire Age >10 years
Notes Bareground 30%, Leaf Litter 4%, Logs 2%, Disturbance Type: sheep grazing, tracks/scats

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	10%	0.4m
Acanthocarpus preissii	1%	0.5m
Cassytha racemosa	0.1%	0.3m
Diplopeltis intermedia var. *intermedia*		
Eriachne obtusa	15%	0.4m
Santalum lanceolatum	0.5%	1m
Scaevola sericophylla	1%	0.5m
Triodia epactia	35%	0.5m

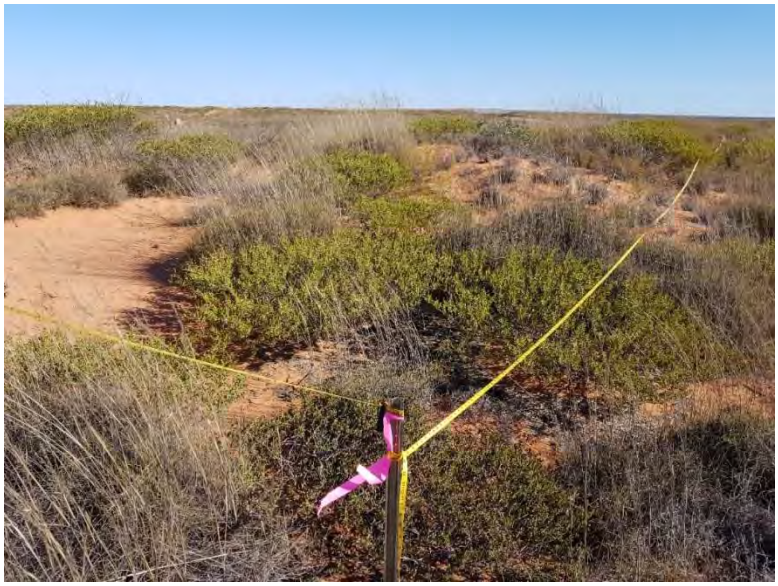
Subsea7, Learmonth Flora and Vegetation Assessment
Site QE27

Described by SF **Date** 21/09/2017 **Type** Q 20m x 20m
Location Exmouth, crest
MGA Zone 50 198594 **mE** 7526648 **mN** 114.073880 **E** -22.339597 **S**
Habitat Coastal Vegetation
Soil orange sand
Vegetation *Acacia stellaticeps* over *Triodia epactia*, sand dune top vegetation
Veg Condition Very Good
Fire Age >10 years
Notes Bareground 30%, Leaf Litter 7%, Logs 0%, Disturbance Type: sheep grazing, tracks/scats

SPECIES LIST:

Name	Cover	Height
Acacia stellaticeps	30%	0.6m
Pileanthus septentrionalis	10%	0.6m
Quoya loxocarpa	0.1%	0.5m
Scaevola sericophylla	5%	0.5m
Triodia epactia	25%	0.5m

Subsea7, Learmonth Flora and Vegetation Assessment
Site QE28



Described by SF **Date** 21/09/2017 **Type** Q 10m x 30m
Location Exmouth, dune top
MGA Zone 50 198531 **mE** 7526896 **mN** 114.073316 **E** -22.337348 **S**
Habitat Coastal vegetation
Soil orange sand
Vegetation *Acacia stellaticeps* over *Triodia epactia*
Veg Condition Very Good
Fire Age >12 years
Notes Bareground 30%, Leaf litter 15%, logs 0%. Disturbance type: grazing, sheep trampling/scats

SPECIES LIST:

Name	Cover	C Class	Height
Acacia stellaticeps	30%		0.6m
Alectryon oleifolius subsp. *oleifolius*	0.1%		0.5m
*Cenchrus ciliaris**	2%		0.5m
Corchorus congener	0.1%		0.3m
Eremophila setacea	0.1%		1m
Pileanthus septentrionalis	15%		0.5m
Triodia epactia	20%		0.5m

Subsea7, Learmonth Flora and Vegetation Assessment
Site QE29

Described by SF **Date** 22/09/2017 **Type** Q 20m x 20m
Location Exmouth, plain
MGA Zone 50 201327 **mE** 7530891 **mN**
Habitat dune base
Soil orange sand
Vegetation *Acacia gregorii* over *Triodia epactia*
Veg Condition Very Good
Fire Age >12 years
Notes Bareground 30%, Leaf Litter 11%, Logs 0%. Disturbance Type: grazing, sheep tracks/scats
Mosaic veg type in between sand dunes

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	20%	0.5m
Diplopeltis intermedia var. *intermedia*	1%	0.5m
Eriachne obtusa	15%	0.5m
Hakea stenophylla	0.1%	0.5m
Heliotropium glanduliferum	0.1%	0.5m
Malvaceae sp.	0.1%	0.5m
Pileanthus septentrionalis	10%	0.5m
Scaevola cunninghamii	0.1%	0.5m
Scaevola sericophylla	0.1%	0.6m
Triodia epactia	15%	0.5m

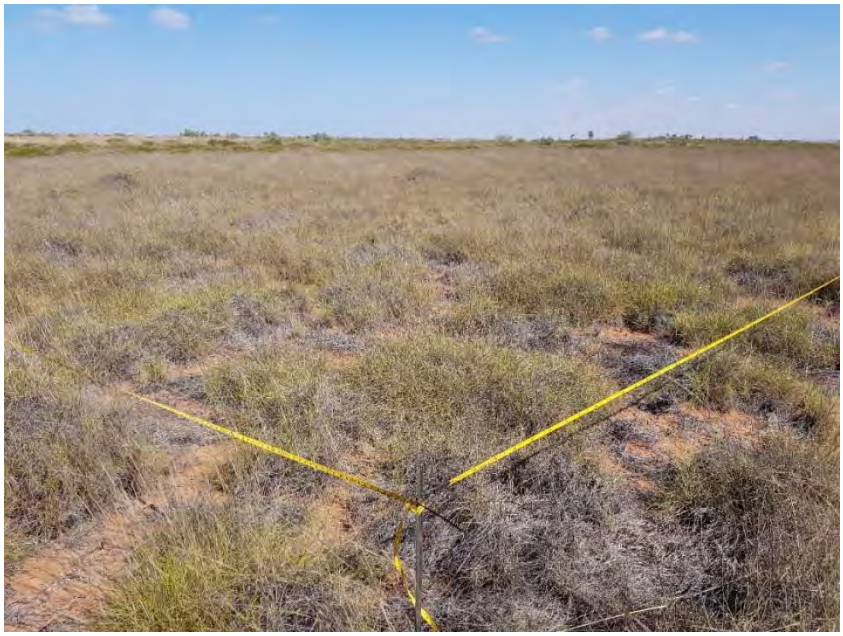
Subsea7, Learmonth Flora and Vegetation Assessment
Site QE30

Described by SF **Date** 22/09/2017 **Type** Q 20m x 20m
Location Exmouth, sand dune top
MGA Zone 50 202663 **mE** 7533056 **mN** 114.114533 **E** -22.282488 **S**
Habitat Coastal Vegetation, sand dune top
Soil orange sand
Vegetation *Acacia stellaticeps* over *Triodia epactia*
Veg Condition Very Good
Fire Age > 15 years
Notes Bareground 16%, Leaf Litter 10%, Logs 0.1%, Disturbance Type: sheep grazing, tracks/scats

SPECIES LIST:

Name	Cover	Height
Acacia gregorii	0.5%	0.5m
Acacia stellaticeps	25%	0.6m
Hakea stenophylla	2%	1.1m
Melaleuca cardiophylla	2%	0.6m
Pluchea ferdinandi-muelleri	0.1%	0.6m
Scaevola cunninghamii	0.1%	0.3m
Scaevola sericophylla	10%	0.5m
Triodia epactia	40%	0.5m

Subsea7, Learmonth Flora and Vegetation Assessment
Site QE31



Described by SF **Date** 22/09/2017 **Type** Q 20m x 20m
Location Exmouth, plain.
MGA Zone 50 202506 **mE** 7532914 **mN**
Habitat Coastal vegetation, plain
Soil sand, soft clay, beige, orange
Vegetation *Triodia epactia* grassland
Veg Condition Very Good
Fire Age > 15 years
Notes Bareground 15%, Leaf Litter 5%, Logs 0%, Disturbance type: sheep grazing, tracks/scats

SPECIES LIST:

Name	Cover	Height
Acanthocarpus preissii	20%	0.5m
Chrysocephalum apiculatum subsp. *racemosum*	0.1%	0.5m
Melaleuca cardiophylla	1%	1m
Rhynchosia minima	0.1%	0.1m
Triodia epactia	65%	0.6m

Subsea7 Learmonth Flora and Vegetation Assessment
Opportunistic Collections

Name

Acacia coriacea
Acacia sclerosperma subsp. *sclerosperma*
Acacia stellaticeps
Chrysocephalum apiculatum
Corchorus congener
Cullen lachnostachys
Dampiera incana var. incana
Eremophila longifolia
Eriachne obtusa
Frankenia pauciflora
Goodenia tenuiloba
Hannafordia quadrivalvis subsp. *recurva*
Heliotropium pachyphyllum
Indigofera chamaeclada
Ipomoea costat
Labichea cassioides
Melaleuca cardiophylla
Olearia sp. Kennedy Range (G. Byrne 66)
Pimelea ammocharis
Pityrodia loxocarp
Pluchea ferdinandi-muelleri
Scaevola sericophylla
Senna glutinosa
Senna notabilis
Stylobasium spathulatum
Triodia schinzi
*Vachellia farnesiana**