

Flora, Vegetation and Fauna Assessment



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Broome Asparagus Farm

Client: Kimberley Asparagus Pty Ltd

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Executive Summary

Kimberley Asparagus Pty Ltd commissioned AECOM (Australia) Pty Ltd (AECOM) to complete biological assessments (the project) for a proposed Asparagus farm survey area in the vicinity of the Broome townsite (27 km east, along Broome Road). The survey area included 957 ha of native vegetation that may potentially be cleared as part of the Project.

AECOM completed a detailed (single-phase) flora and vegetation assessment and level 1 fauna assessment. These assessments included a desktop review of available information including database searches, a field survey component comprising five days traversing the area on foot, targeted conservation significant flora and fauna surveys, and a technical reporting component. The objective of the project was to record, quantify and map conservation significant flora, fauna and communities, and describe the existing environment that enables a likelihood assessment of the presence of significant species. This information can then be used to liaise with government agencies and support the environmental approval process that has already commenced for this project.

The survey area was predominantly traversed on foot walking meandering transects. This facilitated the targeted surveys for the Greater Bilby, and Priority flora considered likely to occur. Three vegetation types and three fauna habitats were encountered, all of which were subject to a minimum of three flora quadrats (17 completed in total), and three fauna grid searches (16 completed in total).

Two potential Priority flora species were recorded, including *Jacquemontia* sp. Broome (A.A. Mitchell 3028), a Priority 1 species, and *Triodia caelestialis*, a Priority 3 species. Both species were recorded extensively within the survey area, and both lack official records with WA Herbarium and Department of Biodiversity, Conservation and Attractions (DBCA) databases. This implies that populations of these species are locally and potentially regionally significant within the survey area. However, records from other projects completed in the vicinity of Broome by AECOM imply that the populations of these species are remarkably under-recorded and under-represented by DBCA and WA Herbarium.

The Greater Bilby is considered likely to utilise one of the fauna habitats present in the survey area (representing 38 % of the total area). However, no recent evidence of the presence of this species was recorded. It is therefore likely that this highly nomadic species would utilise the area, if present in the local vicinity, yet there was no evidence that individuals or populations were present.

An additional ten conservation significant fauna species are anticipated to occur in the survey area despite them not being recorded during the field survey. The field survey presents a snap shot in time of the environmental values, and is not adequate reason to discount the presence of other species. Additional species include the Fork-tailed Swift *Apus pacificus*, Letter-winged Kite *Elanus scriptus*, Peregrine Falcon *Falco peregrinus*, Spectacled Hare-wallaby (mainland) *Lagorchestes conspicillatus leichardti*, *Lerista separanda*, Princess Parrot *Polytelis alexandrae*, Dampierland Burrowing Snake *Simoselaps minimus*, Masked Owl (northern) *Tyto novae-hollandiae kimberli*, and Dampier Peninsula Goanna *Varanus sparnus*.

There were no significant limitations associated with the biological assessments that may have impacted on the survey. The field surveys were undertaken during the ideal survey season, with ample fruit and flowers available for identification and foraging material for fauna species.

At this time, there are no further recommendations for biological investigations.

1.0 Introduction

1.1 Background

Kimberley Asparagus Pty Ltd required a biological survey for an area of approximately 957 hectares of native vegetation within Lots 501-509, 511 and 512 on Deposited Plan 56733, and Lot 454 on Deposited Plan 40702, Roebuck, for the purpose of horticulture.

AECOM Australia Pty Ltd was commissioned to undertake biological assessments (the project) of the proposed horticulture survey area (survey area) including a detailed flora and vegetation assessment including targeted flora surveys, and a level 1 fauna assessment including targeted fauna surveys. The purpose of the biological assessment is to provide an appropriate examination and description of the local environment to ensure that all aspects of ecological significance are identified and recorded.

The results of the biological assessment will assist Kimberley Asparagus in obtaining relevant clearing approvals from the Department of Environmental Regulation.

1.2 Location

The survey area is located in the Kimberley region of Western Australia in the Shire of Broome. The survey area is approximately 27 km from the township of Broome Figure 1.

AECOM was commissioned to survey the project area and was informed that an additional area of significance to the Traditional Owners of the land should also be surveyed if possible. The combination of these two areas was surveyed and will herein be referred to as the survey area. The total survey area size is 957 ha.

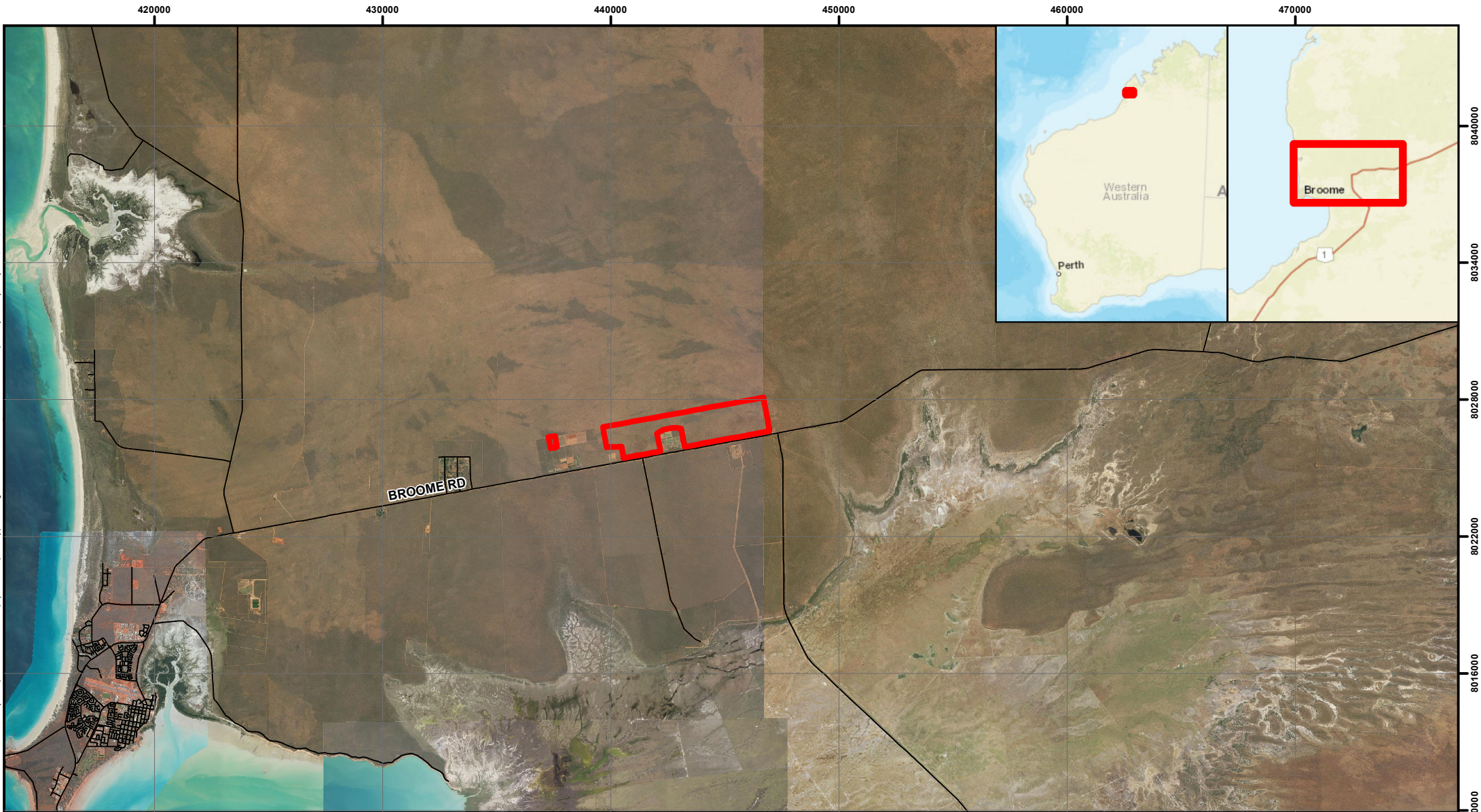
1.3 Objectives

The objective of this biological assessment is to survey the relevant environmental factors of the survey area, including vegetation, flora and fauna habitat. The specific objectives of the assessment were to conduct:

- a detailed (single-phase) flora and vegetation assessment in accordance with the EPA (2016a) Flora Survey Technical Guide
- targeted searches for the following species that may occur within the local area: *Jacquemontia* sp. Broome (Priority 1), *Tephrosia andrewii* (Priority 1), *Bonamia oblongifolia* (Priority 1), *Tetragonia coronata* (Priority 3), *Glycine pindanica* (Priority 3), *Seringia katatona* (Priority 3), *Triodia caelestialis* (Priority 3), *Pterocaulon intermedium* (Priority 3) and *Phyllanthus eremicus* (Priority 3)
- a level 1 fauna assessment in accordance with methodologies stated in EPA (2016b) Terrestrial Fauna Survey Technical Guide
- target Threatened species searches that may occur within the survey area, specifically the Greater Bilby.

This technical document describes the methodology, desktop and field results and provides a preliminary discussion of results.

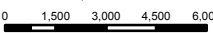
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LEGEND
 Survey Area
 Roads


DATUM GDA 1994, PROJECTION MGA ZONE 51

metres
1:225,000 when printed at A4

Project Area

Broome Asparagus

Biological Survey

Figure
1

Data sources: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

2.0 Existing Environment

2.1 Climate

Broome experiences a tropical climate of hot, humid summers and warm winters. There are two distinct seasons, "the wet" and "the dry". The "wet season" officially commences in October. Most of the annual rainfall for Broome is, on average, from January through to March and can be accompanied by thunderstorms and tropical lows or cyclones. April is classed as the start of the dry season, Broome does not usually experience any significant rain at this time of the year.

The closest meteorological recording station with comprehensive data is Broome Airport (station 3003). The rainfall data shows rainfall patterns from May 2016 to June 2017 (Figure 2). Rainfall in the 12 months preceding the field survey was 1199 mm, a significant increase from the mean annual rainfall of 614 mm. This has led to a good flowering season for the majority of species, and affected the material available for collection during the field survey. In particular, rainfall events in December 2016 to March 2017 led to an excellent survey season. Climate has remained stable with no significant deviations from the monthly mean over time.

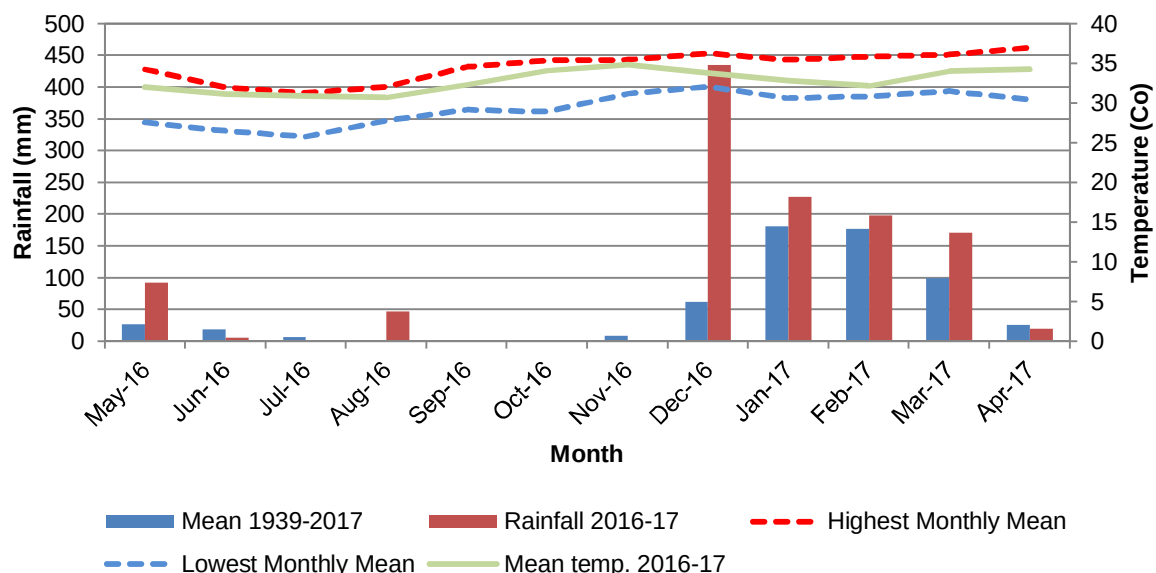


Figure 2 Climate data from Broome Airport station (no. 3003) showing rainfall and temperature mean (1939-2017) and in the 12 months preceding the field survey in May 2017 (source: BOM, 2016)

2.2 IBRA Regions

The largest regional vegetation classification scheme recognised by EPA is the Interim Biogeographical Region of Australia (IBRA). The IBRA regions provide the planning framework for the systematic development of a comprehensive, adequate and representative (CAR) national reserve system. There are 89 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Department of Conservation and Land Management [CALM], 2002).

The survey area lies within the Pindanland subregion of the broader Dampierland IBRA region. Dampierland, described by Cotching (2005), is located in the Kimberley region has a semi-arid monsoonal climate where rainfall occurs predominantly between December and April. The area includes the Canning Basin with dunefields and intermittent swales. The surface of Canning Basin is gently undulating Aeolian sand plains that slope gently towards the coast. Isolated mesas and hills feature in the landscape as do dunefields of long linear sand dunes. Dampierland is divided into two subregions, the Fitzroy Trough and Pindanland.

The Pindanland subregion, described by Graham (2001), is the coastal semi-arid north-western margin of the Canning Basin comprised of Quaternary sandplains mantling Jurassic and Mesozoic sandstones. The subregion includes:

- sandplains with hummock grasslands
- marine deposits on coastal plains with mangroves and Samphire grass
- alluvial plains of tree savannahs and ribbon grass with riparian forests fringing the drainage channels.

The dominant land use is grazing and crown Reserve. Rare features include patches of rainforest found behind the coastal primary dune system, extensive mudflats of Roebuck Bay and Eighty Mile Beach, migratory birds of Roebuck Bay and Eighty Mile Beach, rare flora, vast grasslands of Roebuck Plains, coastal swamps adjacent to Eighty Mile Beach and, Claypans supporting uncommon aquatic plants.

2.3 Vegetation

Beard (1981) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. EPA's objective is to retain at least 30% of all pre-European ecological communities, which is consistent with recognised retention levels (EPA 2015).

The survey area is mapped as vegetation association 750, described by Beard as "Shrublands, pindan; *Acacia tumida* shrubland with Grey Box & Cabbage Gum medium woodland over Ribbon Grass & Curly Spinifex". There is currently 99.56 % remaining of this vegetation association in the State, and 99.68 % remaining in Dampierland.

Department of Agriculture and Food completed land system mapping in the Broome region in 1954. Land systems is defined as 'an area or group of areas through which there is a recurring pattern of topography, soils and vegetation' (DAF, 2011). The survey area intersects the Wanganut and Yeeda land systems, described as:

- Wanganut land system: low lying sandplains and dune fields with through going drainage supporting pindan *Acacia* shrublands with emergent Eucalypt trees.
- Yeeda land system: sandplains with red and yellow sands supporting pindan *Acacia* shrublands with emergent Eucalypt trees.

3.0 Legislative Framework

3.1 EPBC Act

3.1.1 Matters of National Environmental Significance

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the main piece of Federal legislation protecting biodiversity in Australia. All matters of national environmental significance (MNES) are listed under the EPBC Act. These include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

3.1.2 Flora and fauna

Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 1.

Table 1 Categories of Species Listed under Schedule 179 of the EPBC Act (Commonwealth)

Conservation	Code Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent
OS	Other specially protected fauna

3.1.3 Vegetation Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 2.

Table 2 Categories of TECs that are listed under the EPBC Act

Conservation Code	Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

3.2 Western Australian legislation

3.2.1 Flora and fauna

Threatened flora are plants which have been assessed as being at risk of extinction (DEC 2012). Under the *Wildlife Conservation Act 1950 (WC Act)*, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection (WAH 1998-).

It is an offence to “take” or damage Rare Flora without Ministerial approval. Section 23F of the *WC Act* defines “to take” as “to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means”.

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *WC Act*. These categories are defined in Table 3.

Table 3 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Code	Category
CR	Critically endangered species / Schedule 1
EN	Endangered species / Schedule 2
VU	Vulnerable species / Schedule 3
EX	Presumed extinct species / Schedule 4
IA	Migratory birds protected under an international agreement (fauna only) / Schedule 5
CD	Special conservation (fauna only) / Schedule 6
OS	Special protection for reasons other than those already mentioned (fauna only)

Species that have not yet been adequately surveyed to warrant being listed under the *WA Act*, or are otherwise data deficient, are added to a Priority Lists under Priorities 1, 2 or 3 by the State Minister of Environment. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. Categories and definitions of Priority Flora and Fauna species are provided in Table 4 and expanded in Appendix A.

Table 4 Conservation codes for WA flora and fauna as listed by DBCA and endorsed by the Minister for Environment

Conservation Code	Category
Priority One	Poorly Known Species
Priority Two	Poorly Known Species
Priority Three	Poorly Known Species
Priority Four	Rare, Near Threatened and other species in need of monitoring

3.2.2 Vegetation Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both state and commonwealth legislation.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the TEC Scientific Committee. Categories of TECs are defined in Table 5.

Department of Biodiversity Conservation and Attractions (DBCA) maintains a database of state listed TECs which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 3. 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. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and categories are described in Table 6.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

There is currently no formal protection afforded to TECs listed at the state level.

Table 5 Conservation codes for State listed Ecological Communities

Conservation Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 6 Categories for Priority Ecological Communities

Conservation	Code Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	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.
P5	Priority Five: Conservation Dependent ecological communities.

3.2.3 Communities of local, regional and national significance

Significant flora and vegetation units need to take into account a number of other features other than statutory listings in accordance with the Flora and Vegetation Survey Technical Guide (DBCA & EPA, 2015). These include the following:

- Keystone role in particular habitat for threatened or Priority flora or fauna species or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representative of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- The presence of restricted subspecies, varieties or naturally occurring hybrids
- Local endemism or association with a restricted habitat type (e.g surface water or groundwater dependent)
- Being poorly reserved.

Vegetation may be significant for a range of reasons (DBCA & EPA, 2015) including:

- restricted distribution
- degree of historical impact from threatening processes
- local endemism in restricted habitats
- novel combinations of taxa
- a role as a refuge
- being representative of a vegetation unit in pristine condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range
- being poorly reserved.

4.0 Methodology

The biological assessments incorporated three tasks: a desktop assessment, field survey, and a reporting component. These are described in detail below.

4.1 Desktop Assessment

The desktop assessment involved gathering background information for the local area. The objective of the desktop assessment is to:

- identify significant environmental values likely to be present in the survey area (including flora, fauna, soil, groundwater and surface water)
- identify the location of any conservation estates or reserves within or near the survey area
- identify broad vegetation types present using pre-European types
- identify conservation significant species likely to be present in the survey area and include a likelihood of occurrence assessment.

Desktop database searches were requested from government databases (including a 40 km buffer from survey area boundary):

- DBCA Threatened and Priority Flora List and WA Herbarium records
- DBCA Threatened and Priority Ecological Communities database
- DBCA and WA Museum fauna database records
- Naturemap
- *Environment Protection and Biodiversity Conservation Act* (EPBC Act) Protected Matters database
- Department of Environment Regulation preliminary assessment of native vegetation for Kimberley Asparagus Pty Ltd (2017).

Literature was consulted to identify broad vegetation types and describe the existing environment. References included Beard (1981) vegetation mapping, Geological Survey of Western Australia and Geoscience (2008), Bureau of Meteorology climate data (2017) and WA Atlas (Landgate 2017). The search results were reviewed to assess the potential presence of conservation significant environmental values. The desktop assessment was also used to define the survey time to maximise capturing the ideal flowering period for conservation significant flora species. All conservation significant matters including flora, fauna and communities were reviewed and a likelihood of occurrence was completed based on the categories (Table 7).

Table 7 Categories of likelihood of occurrence for species and communities

Likelihood Category	Flora	Fauna	Communities
Likely to occur	Habitat is present in the survey area and the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, habitat is present in the survey area and the species has been recorded in close proximity to the survey area.	Known occurrences of the community in close proximity to the survey area. Vegetation looks the same within the known occurrence and survey area based on aerial imagery. Geographic location is similar to the survey area.

Likelihood Category	Flora	Fauna	Communities
May occur	Habitat may be present and/or the species has been recorded in close proximity to the survey area.	Survey area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the survey area.	Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and survey area based on aerial imagery. Geographic location is similar to the survey area.
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Survey area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the survey area.	Known occurrence of the community in close proximity to the survey area however geographic location does not occur in survey area.

4.2 Flora and Vegetation

The detailed flora and vegetation assessment was undertaken in accordance with EPA (2016a) Flora Survey Technical Guide. A field survey was undertaken following completion of the desktop assessment. Information gathered during the desktop assessment informed the field survey sample design, intensity and survey timing. This ensured that the field survey was undertaken during ideal detection periods for environmentally significant features that were considered likely to occur in the survey area.

Preliminary mapping of vegetation communities was undertaken prior to conducting the field survey to ensure that a minimum of three quadrats were sampled within distinct vegetation communities based on a review of aerial imagery.

The field survey was undertaken by Floora de Wit (collection permit SL011912) between 8 and 12 May. Floristic data was sampled from a combination of quadrats and relevés. Non-permanent 50 x 50m quadrats were defined by a measuring tape wherein which floristic data was collected. Data collected included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each sample point location was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- photograph
- soil details (type, colour, moisture)
- topography
- vegetation condition using the Keighery (1994) scale
- disturbance notes
- fire history
- species present
 - estimated height
 - estimated percentage cover.

Changes in floristic composition and structure were recorded and mapped as the survey area was traversed on foot.

One hundred and eleven flora specimens were collected which were unable to be accurately identified in the field. Specimens were dried and pressed as per the WA Herbarium guidelines. These specimens were identified in AECOM's in-house herbarium and taxonomic references, keys and specimen vaults at the WA Herbarium. Species naming of species followed the convention of the WAH. Ten specimens were submitted to DBCA for identification by WA Herbarium taxonomist Mike Hislop. These include the verification of potential Priority species *Triodia caelestialis* (P3) and *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (P1). Species not able to be accurately identified due to missing diagnostic material are depicted with a question mark "?" before the genus or taxon name.

4.2.1 Vegetation mapping

Delineation of vegetation communities was supported by analysing floristic data collected within quadrats. The program PC Ord was used to assess the similarity between sites and review dendrograms using Ward's distance measure. This identified those sites that are most similar to one another and suitable for representing the same vegetation community. The analysis was done using presence absence data and scaled percentage cover applying the Braun-Blanquet scale as outlined in Table 8.

Quantitative flora species data were used to define the vegetation communities. Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003). Vegetation was described at the Sub-Association (plant community) level.

Table 8 Braun-Blanquet scale (Braun-Blanquet et al. 1932)

Scale	Range of cover
5	75-100
4	50-75
3	25-50
2	5-25
1	<5 numerous individuals
+	<5 few individuals
R	Solitary, with small cover

Vegetation condition was determined using the scale developed by Trudgen (1988) for the northern botanical province (Table 9), as recommended in the Flora Survey Technical Guide (EPA, 2016a). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

Table 9 Bushland condition ratings

Descriptor	Northern Botanical Provinces Scale (Trudgen, 1988)
Pristine	NA
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
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.
Good	Most 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.

Descriptor	Northern Botanical Provinces Scale (Trudgen, 1988)
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.
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.
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.

4.3 Fauna survey

A Level 1 Fauna Assessment was conducted in accordance with EPA Guidance Statement No. 56 (EPA, 2004b) and Fauna Survey Technical Guide (EPA & DEC, 2010). Fauna species and habitat data was collected at sample point locations within the survey area. Sample point locations were selected in areas considered representative of the vegetation types and fauna habitat types present.

Various habitat features were assessed and used to inform the fauna habitat map and were used to determine suitability of habitat for conservation significant fauna species, including consideration of structural diversity and refuge opportunities for fauna.

In addition to recording all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings were documented. In particular, attention was given to searching for conservation significant species identified in the desktop assessment as having the potential to occur in the area. All observations were made between daylight hours of 0700 and 1800.

Microhabitat searches of leaf litter, bark, fallen logs and rocks were conducted opportunistically as the survey area was traversed on foot. This included raking soil and leaf litter, inspecting dead logs and timber, inspecting burrows, lifting rocks and inspecting loose bark on trees.

Five scat and owl casts were collected and sent to a consultant for analysis.

The taxonomy and nomenclature of vertebrate species used is in accordance with the Western Australian Museum's Checklist of Vertebrates of Western Australia (WAM, 2016).

4.3.1 Targeted Greater Bilby survey

Surveying for the presence of the Greater Bilby involved walking survey area-wide transects and systematic quadrat searches within and outside of the survey area. The zoologist carried infra-red triggered cameras to be deployed in the event of identifying an active burrow system or recent bilby activity. The infra-red cameras were not deployed as no active burrows were identified. The AECOM team traversed three meandering transects on an east-west axis throughout the survey area and outside the survey area to locate potential Greater Bilby evidence. Furthermore, grid searches were conducted within 2 ha of potential diggings or burrows. Additionally, 2 ha grid searches were conducted in other areas of the survey area including potential Greater Bilby Habitat and to be sure, in non-preferred Greater Bilby habitat. Locations of grid searches are presented in Figure 9. The search methodology was adapted from Moseby *et al*, 2012 and had been confirmed by DBCA prior to another targeted bilby assessment in the same region (T. Sonneman - DBCA, pers. comm 01 April 2015).

4.3.2 Fauna habitat mapping

The fauna habitats of the survey area were assessed and mapped in conjunction with the vegetation mapping. Fauna habitats were assessed for specific habitat components in order to determine the potential for these habitats to support conservation significant species.

Information collected included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presences and abundance of hollows, fallen logs, leaf litter, bare ground, grass, stones and boulders, rock crevices, soil cracks, cryptogamic crust, vines, mistletoe, dense shrubs, water bodies etc.
- Presence of animal signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Fauna observations
- Potential significance of habitat.

5.0 Survey Limitations

Limitations are inherent with any biological assessment. The limitations associated with the biological assessment are outlined in Table 10, as specified in EPA (2016a) Flora Survey Technical Guide.

Table 10 Limitations of the assessment

Limitation	Flora and Vegetation assessment	Fauna assessment
Availability of contextual information on the region	Nil. Land System mapping and Beard mapping available for contextual information. Surveys conducted in the region by AECOM include project areas in close proximity to the site.	Minor. No previous studies were found to be available in the public domain. Surveys conducted in the region by AECOM include project areas in close proximity to the site.
Competency/experience of consultant conducting survey	Nil. Floora de Wit has 10 years' experience undertaking flora and vegetation assessments, with the past five years including numerous Kimberley surveys. Cryptic plant specimens and potential conservation significant species were submitted to DBCA for confirmation by Mike Hislop.	Nil. Matt Cann has 6 years of zoological survey experience. He has conducted numerous Greater Bilby surveys in the Broome Shire since 2011.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	Nil. All flora species encountered were collected and identified at the state herbarium. The species area curve indicates that 94 % of anticipated species have been recorded. Seventeen quadrats were completed. Three flora species were unable to be accurately identified to species and have been demarcated with a '?'. One specimen lacked fruit and flower material and the other was a juvenile species.	Minor. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1800hrs). Nocturnal species were predominantly observed through indirect evidence. Due to the highly nomadic nature of the Greater Bilby, motion cameras were only to be deployed in the event of finding an active burrow system or recent evidence. Information gained for a Level 1 fauna survey was sufficient.
Completeness (was relevant area fully surveyed)	Nil. The entire survey area was traversed on foot including in adjacent vegetation to provide local context.	
Remoteness and/or access problems	Nil. The entire survey area was traversed on foot walking meandering transects. The vehicle was able to be parked in close proximity at all times enabling the team to commence the transects.	
Timing, weather, season, cycle	Nil. The survey was conducted during the post-wet season following significant rainfall events. Many plants were in flower and/or fruit, ensuring sufficient identification material and providing food for fauna ensuring that animals are active at the time of the survey.	
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	Nil. There have been no recent floods or fire that may have affected the survey results. Minor clearing for fire breaks and access tracks are not considered to have affected results.	

6.0 Desktop Assessment Results

6.1 Environmentally Sensitive Areas

There are no environmentally sensitive areas that have been recorded within or in close proximity to the survey area.

There is one Public Drinking Water Source located approximately 10km northwest of the survey area.

6.2 Wetlands

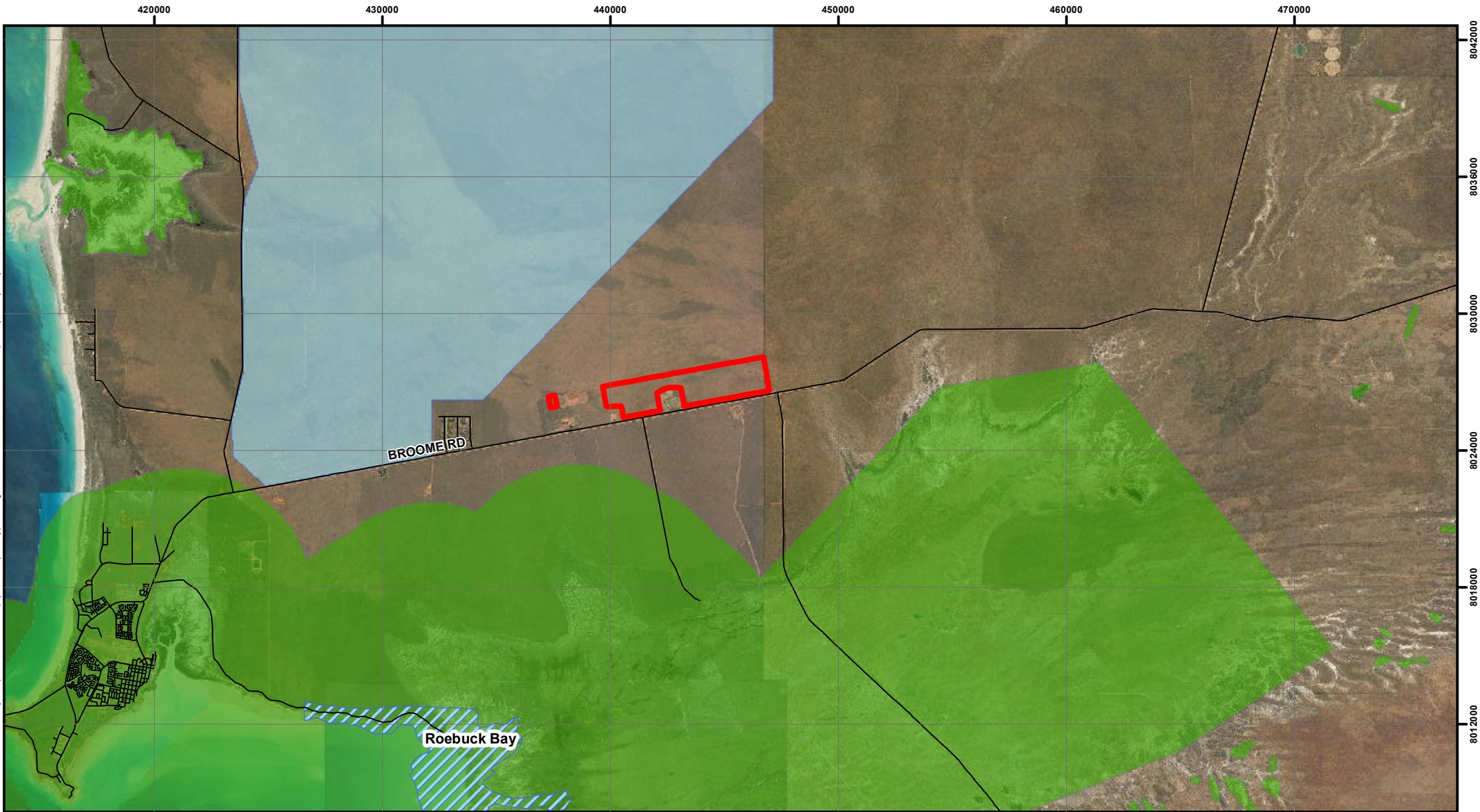
Roebuck Bay is the only wetland found in the area and is a Ramsar listed site and is of international importance, Roebuck is an intertidal mud and sand flat that supports vast flora and fauna in the area. The site is a superb example of a tropical marine embayment within the Northwest bioregion. It is one of only a dozen intertidal flats worldwide where benthic food sources are found in sufficient densities that they regularly support internationally significant numbers of waders (Bennelongia 2009).

The Roebuck Bay Ramsar Site contains four different marine or coastal wetland types and details of these wetlands are outlined in Table 11.

Table 11 Wetlands of the survey area

Wetland	Management category	Geomorphic classification
Sea- Grass Beds	Conservation	Marine subtidal aquatic beds
Intertidal mud and sand flats	Conservation	Flats
Intertidal forested wetlands	Conservation	mangrove swamps
Intertidal marshes	Conservation	samphire and saline grasslands

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LEGEND

- Survey Area
- Roads
- Ramsar Wetlands
- Environmentally Sensitive Areas
- Public Drinking Water Sources

N
DATUM GDA 1994, PROJECTION MGA ZONE 51
0 1,500 3,000 4,500 6,000
metres
1:225,000 when printed at A4

Environmentally Sensitive Areas

Broome Asparagus

Biological Survey

Figure
3

Data sources:
Base Data: (c) Based on information provided by and
with the permission of the Western Australian Land
Information Authority trading as Landgate (2010).

6.3 Vegetation

6.3.1 Threatened and Priority Ecological Communities

There are no Threatened or Priority (TEC or PEC) communities that are known to occur within the survey area. There are two TECs of which the buffer occurs within 10 km of the survey area. These include:

- EPBC Act listed Endangered TEC: Monsoon vine thickets
- WC Act listed Vulnerable TEC: Roebuck Bay mudflats.

Neither of these are considered likely to occur within the survey area, as is evident when reading their descriptions below.

TEC (Endangered): Monsoon vine thickets

The Monsoon Vine Thickets are considered a rainforest subset ranging from semi-deciduous vine thickets to closed semi-deciduous vine forest. The community contains deciduous, semi-deciduous and evergreen perennial flora species and provides an important habitat for a number of restricted or rare plant species. This includes *Parsonsia kimberleyensis* which is at the southern-most limit of its range within the ecological community.

The ecological community is predominantly restricted to the coastlines of the Dampier Peninsula from Broome in the south to One Arm Point in the north and on the north-eastern coast of the Peninsula from One Arm Point to Goodenough Bay. The ecological community represents the most southern occurrences of rainforest type vegetation in Western Australia.

TEC (Vulnerable): Roebuck Bay mudflats

Roebuck Bay was designated a “Wetland of International Importance” under the Ramsar Convention in June 1990. Roebuck Bay was listed as a Ramsar site under seven of the nine criteria. Roebuck Bay is one of less than twenty soft bottom intertidal mudflats worldwide that support very large numbers of migratory shorebirds that comprise the primary staging and over-wintering areas for Palaearctic shorebirds on their annual southwards migrations. The high biomass of benthic invertebrates at Roebuck Bay (for a tropical mudflat) is a key characteristic that makes it such an important shorebird habitat.

The soft bottom intertidal mudflats of the northern and eastern shores of Roebuck Bay, and high tide roosts at Bush and Sandy Points are the most biologically significant parts of the site, which was listed for several reasons including, most notably, outstanding shorebird values.

6.4 Conservation Significant Flora

The desktop assessment identified 31 flora species of conservation significance that may occur within or in the vicinity of the survey area. This includes two species listed as Threatened under the EPBC Act and WC Act. Both these species are considered unlikely to occur due to their restricted known occupancy and preferred habitat. The remaining 29 species are Priority flora. Of these, seven are considered likely to occur and ten may occur (Table 12).

A preliminary assessment was undertaken in 2017 by DER who suggested that *Seringia exastia* may exist in the survey area given the soil and vegetation types present. This species is known from two populations on the Broome Peninsula, and scattered records on the edge of the Great Sandy Desert. It is often recorded on flat land with *Triodia schinzii* and scattered trees of *Acacia colei* and *Eucalyptus dampieri*.

A comprehensive species list including habitat, last count date, flowering period and number of records are presented in Appendix A.

Table 12 Threatened and Priority Flora that may occur in the survey area identified from database searches with descriptions sourced from Florabase (WAH 1998-)

Species	Cons. Code	Habitat	Likelihood
<i>Aphyllodium parvifolium</i>	P1	In greyish pindan soil, sand and sandhills.	May
<i>Aphyllodium glossocarpum</i>	P3	Sand. Pindan.	May
<i>Croton aridus</i>	P3	Deep red sand, pindan soil. Sandplains or ridges, spinifex sandplains.	May
<i>Glycine pindanica</i>	P3	Pindan, red sand.	Likely
<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)	P1	Brown Orange Sand on Plain.	Likely
<i>Phyllanthus eremicus</i>	P3	Red Pindan and Sand.	Likely
<i>Polymeria</i> sp. Broome (K.F. Kenneally 9759)	P1	Red pindan soil.	May
<i>Pterocaulon intermedium</i>	P3	Partly cleared pindan sandplain.	May
<i>Seringia exastia</i>	T	Flat pindan soils.	May
<i>Seringia katatona</i>	P3	Red sand.	May
<i>Stylidium pindanicum</i>	P3	Clay flat.	May
<i>Terminalia kumpaja</i>	P3	Pindan, sandy.	Likely
<i>Triodia acutispicula</i>	P3	Orange, silty sand.	May
<i>Triodia caelestialis</i>	P3	Brown orange sand on plain.	Likely
<i>Tephrosia andrewii</i>	P1	Pindan Sand.	Likely
<i>Tetragonia coronata</i>	P3	Red clay loam.	Likely
<i>Tribulopsis marliesiae</i>	P3	No information available.	May

6.5 Conservation Significant Fauna and Fauna Habitat

6.5.1 Fauna species

A total of 115 Threatened, Priority and Migratory fauna species were identified from the database searches. Of these, 85 were omitted after an initial assessment due to unsuitable habitat present in the survey area. These species included 63 Migratory/Marine bird species. The intertidal Ramsar listed Roebuck Bay is approximately 7 km southwest of the survey area. The proximity of this Ramsar wetland will influence the occurrence of these bird species that may fly over the area when transiting to and from the wetland however none are expected to utilise any habitat within the survey area. Other marine species omitted included sea snakes, turtles, fish and sharks. Two mammals were excluded; the Water Mouse due to unsuitable habitat and the Burrowing Bettong (inland) as this species is now extinct.

In addition to these desktop searches, it is noted that a site visit was conducted by Department of Water and Environment Regulation (DWER) officers in relation to this project. DER officers noted that the survey area has the potential to provide suitable habitat for the Greater Bilby (*Macrotis lagotis*), the Spectacle Hare-wallaby (*Lagorchestes conspicillatus leichardti*) and the Dampier Peninsula Goanna (*Varanus sparnus*) (DER, 2017).

In total, 16 birds, 10 mammals and five reptiles were considered to have some potential of occurring in the survey area. Of these, three species are considered likely to occur and nine species may occur. Database search results and the analysis of these are provided in Table 13. The EPBC Act Protected Matters report is presented in Appendix B.

Table 13 Records of Threatened and Priority Fauna from the vicinity of the survey area identified from DBCA database searches, the EPBC Protected Matters Report and publicly available literature

Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Hirundo rustica gutturalis</i>	Barn Swallow	Migratory	IA	The Barn Swallow is widespread in northern Australia during the summer months. Habitat includes open country, agricultural land, especially near water, railyards and towns (Pizzey & Knight, 2007).	Likely to occur around September to March.
<i>Macrotis lagotis</i>	Greater Bilby, Dalgyte, Ninu	Vulnerable	VU	The Bilby is the sole surviving member of the sub-family <i>Thylacomyinae</i> (Family <i>Peramelidae</i>) (Pavey, 2006). It is a slight, rabbit-sized marsupial with soft grey fur covering most of the body, large ears and a long, pointed snout. The Bilby occupies arid to semi-arid woodlands and hummock grasslands in the north of Australia. The Bilby formerly occupied much of the Australian mainland however has experienced a vast contraction in its range (Van Dyck & Strahan, 2008).	Likely to occur
<i>Merops ornatus</i>	Rainbow Bee-eater	Marine	IA	The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests. It is possible that this species will occupy open woodland areas within the survey area. The Rainbow Bee-eater avoids heavy forest that would hinder the pursuit of its insect prey (Morcombe, 2003).	Likely to occur
<i>Apus pacificus pacificus</i>	Fork-tailed Swift	Migratory	IA	The Fork-tailed Swift is almost exclusively aerial, and a non-breeding visitor to Australia (DoEE, 2017). They are rarely seen roosting on land.	May occur
<i>Elanus scriptus</i>	Letter-winged Kite	-	P4	The Letter-winged Kite is visually similar to the Black-shouldered Kite but has a dark bar underwing as a discernible feature. Letter-winged Kites are gregarious and are often recorded in flocks. They occupy semi-desert and desert along tree-lined creeks, grasslands and other low vegetation (Morcombe, 2003).	May occur
<i>Falco peregrinus</i>	Peregrine Falcon	-	OS	A well-known falcon, the Peregrine inhabits a vast array of environs in Australia. It is usually uncommon and migratory (Pizzey & Knight, 2007). This species lays its eggs in recesses of cliff faces, tree hollows or large abandoned nests (Bamford, 2009)	May occur

Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby (mainland)	-	P3	The Spectacled Hare-wallaby is a rare mammal found in scattered populations in the Kimberley (Johnson & Thomson-Dans 2009). Preferred habitat includes open woodlands, shrublands and hummock grasslands (Australian Wildlife Conservancy 2011). It has been recorded east and south of the area from road kill and camera trap records (DER, 2017).	May occur
<i>Lerista separanda</i>	A skink	-	P2	<i>Lerista separanda</i> occupies sandy areas of the south west Kimberley coast, between Kimbleton and Nita Downs. It is known from sparse records in this area (Wilson & Swan, 2010).	May occur
<i>Polytelis alexandrae</i>	Princess Parrot	-	P4	The Princess Parrot's natural range covers some of the most arid habitats in Australia. It spends much of its time on the ground foraging for seed. It frequents arid areas with eucalypts, casuarinas, acacias, spinifex and is often found in the vicinity of salt lakes (Morcombe, 2007).	May occur
<i>Simoselaps minimus</i>	Dampierland Burrowing Snake	-	P2	This burrowing snake is known from few records and is presumed to feed largely on <i>Lerista</i> Skinks (Wilson & Swan, 2010).	May occur
<i>Tyto novaehollandiae kimberli</i>	Masked Owl (Kimberley)	-	P1	The distribution of the Masked Owl is poorly known but thought to include Kimberley, Northern Territory and Cape York regions. The few records from the Kimberley show them to occur from Yampi Sound north-east to Cambridge Gulf, including Windjana Gorge and Augustus Island (TSSC, 2015c).	May occur
<i>Varanus sparnus</i>	Dampier Peninsula Goanna	-	P1	The Dampier Peninsula Goanna was first described in 2014 and is known from only four locations. It has been recorded in Pindan Shrubland habitat (DER, 2017).	May occur
<i>Cecropis daurica</i>	Red-rumped Swallow	Migratory	IA	A medium to large swallow, this species is an occasional to northern Australia. It inhabits open country and coastal grasslands (Morcombe, 2003).	Unlikely to occur

Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Ctenotus angusticeps</i>	Airlie Island <i>Ctenotus</i>	Vulnerable	VU	Recent surveys have revealed additional populations along the north-western coast, which appear to be highly restricted to specific habitats, primarily salt marsh communities adjacent to mangroves where lizards shelter down crab holes.	Unlikely to occur
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	EN	The Northern Quoll occurs in the Pilbara and further north through to the Kimberley. The species occupies a wide range of habitats including, rocky areas, eucalypt forest and woodlands, sandy lowlands and beaches, shrubland, grassland and desert (DoEE, 2017).	Unlikely to occur
<i>Erythroriorchis radiatus</i>	Red Goshawk	Vulnerable	VU	This species occurs in a patchy widespread distribution across coastal and sub-coastal regions of northern and eastern Australia. One sub-population occurs on the mainland, comprising approximately 1,200 individuals. They inhabit coastal and sub-coastal tall open forests and woodlands, tropical savannas traversed by wooded or forested rivers, and edges of rainforests on fertile soils (TSSC, 2015)	Unlikely to occur
<i>Erythrura gouldiae</i>	Gouldian Finch	-	P4	In the Kimberley this species is known from several small breeding populations of up to 120 adults known from the east, the centre and west to Dampierland. They feed almost exclusively on grass seed and depend on a small number of grass species. They nest in tree hollows between April-July. When breeding they use small patches of open woodland, often on ridges dominated by cavity bearing trees such as <i>Eucalyptus brevifolia</i> and <i>E. tintinnans</i> (TSSC, 2016a).	Unlikely to occur
<i>Falco hypoleucos</i>	Grey Falcon	-	VU	The Grey Falcon is a rare, pale grey inland falcon that inhabits inland plains, gibber deserts, pastoral lands and timbered watercourses (Pizzey & Knight, 2007).	Unlikely to occur
<i>Hirundapus caudacutus</i>	White-throated Needletail	Migratory	IA	A large swift, predominantly from eastern and south-eastern Australia, vagrant individuals have been recorded in Western Australia (DOEE, 2017).	Unlikely to occur

Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Isoodon auratus auratus</i>	Golden Bandicoot (mainland), wintarru	Vulnerable	VU	The Golden Bandicoot is a small golden-brown marsupial with a typically long pointed head and squat body. The Golden Bandicoot has golden hairs over its head and body hence its name. It is now restricted in its former range which included western, central and northern Australia. It occurs on the Kimberley mainland at Yampi Peninsula, Artesian Range, George Water and Prince Regent Nature Reserve, Western Australia (TSSC, 2015b).	Unlikely to occur
<i>Ixobrychus flavicollis australis</i>	Black Bittern (southwest subpop.)	-	P1	The Australian Black Bittern is a sooty dark Bittern with a slender head, dark stiletto like bill and yellowish on the underside. The known range extends from the Pilbara across to far eastern Victoria (Pizzey & Knight, 2007).	Unlikely to occur
<i>Liopholis kintorei</i>	Great Desert Skink	Vulnerable	VU	This species is generally restricted to sandy areas of the south-west Kimberley coast (Wilson & Swan, 2010).	Unlikely to occur
<i>Malurus lamberti bernieri</i>	Shark Bay Variegated Fairy-wren	-	VU	This sub-species of the Variegated Fair-wren is constricted to Bernier Island on the west coast of Western Australia. (Pizzey & Knight, 2007).	Unlikely to occur
<i>Mesembriomys macrurus</i>	Golden-backed Tree-rat	-	P4	The Golden-backed Tree-rat has undergone significant range contraction and is now only found in the Kimberley where mean rainfall exceeds 600mm. It is highly arboreal but does spend large amounts of time on the ground. It is now mainly recorded in rainforest patches on volcanic, lateritic, sandstone surfaces and eucalypt woodlands over tussock or hummock grasslands (Van Dyck & Strahan, 2008).	Unlikely to occur
<i>Mormopterus loriae cobourgiana</i>	Little North-western mastiff Bat	-	P1	The Little North-western Mastiff Bat occurs along the Western Australian coast from Lake McLeod to Point Torment in Western Australia. They occur sparsely within its range and in Western Australia have only been recorded from mangrove stands (Van Dyck & Strahan, 2008).	Unlikely to occur

Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Motacilla cinerea</i>	Grey Wagtail	Migratory	IA	The Grey Wagtail is a scarce but regular visitor to northern Australia, typically arriving in October and leaving in March. The species is most commonly associated with water and are found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (Referral guideline for 14 birds listed as migratory species under the EPBC Act, Australian Government, 2015).	Unlikely to occur
<i>Motacilla flava</i>	Yellow Wagtail	Migratory	IA	A summer migrant to Australia, the Yellow Wagtail inhabits open habitats and is often recorded near water (Morcombe, 2003).	Unlikely to occur
<i>Phascogale tapoatafa kimberleyensis</i>	Kimberley Brush-tailed Phascogale	Vulnerable	VU	The Brush-tailed Phascogale (Kimberley) originally occurred in coastal and near coastal areas from Kalumburu to Broome. Its current status in the Kimberley is unclear as numerous surveys have recorded few sightings. The subspecies typically occurs in savanna woodland and diet consists mainly of invertebrates found under bark and sometimes consumes nectar when available (DotE, 2015).	Unlikely to occur
<i>Saccolaimus saccolaimus nudicluniatus</i>	Bare-Rumped Sheath-tailed Bat	VU	VU	There have only been two records of this species in the last two decades, both of north-eastern Queensland. In the Northern Territory there have been confirmed old records in Kakadu National Park. This species has not been recorded in Western Australia (TSSC, 2016b).	Unlikely to occur
<i>Trichosurus vulpecula arnhemensis</i> (Kimberley)	Northern Brushtail Possum (Kimberley)	-	VU	The Kimberley subspecies of the Northern Brushtail Possum is declining and has lost much of its former range (Van Dyck & Strahan, 2008).	Unlikely to occur
<i>Wyulda squamicaudata</i>	Scaly-tailed Possum	-	P3	The Scaly-tailed Possum is one of three Australian possums known to shelter exclusively in rocks. While it is not sheltering though it inhabits open woodland and closed forest, sometimes with rainforest vegetation components (Van Dyck & Strahan, 2008).	Unlikely to occur

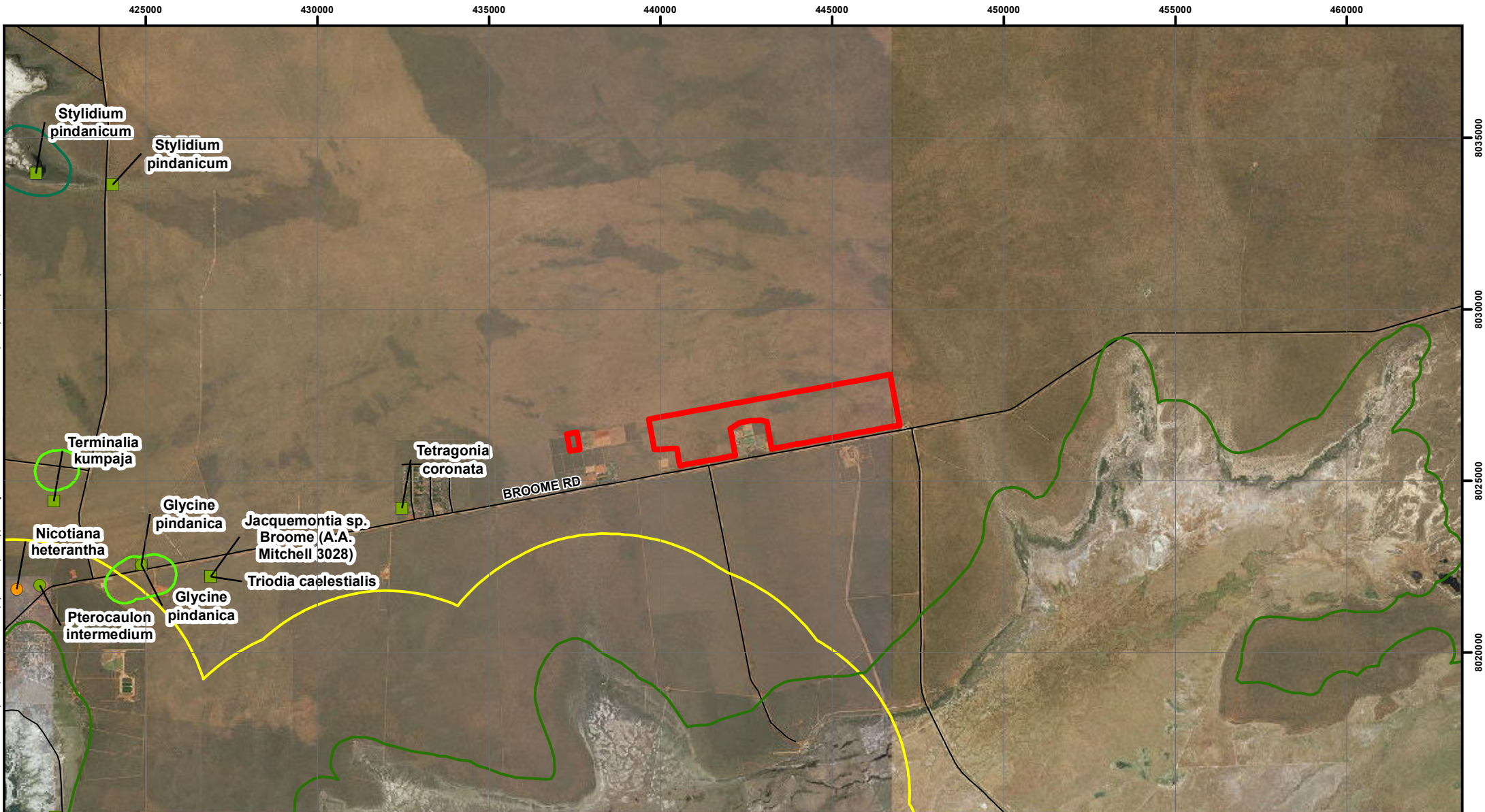
Species	Common Name	National EPBC Act	State WC Act & DBCA	Habitat	Likelihood of Occurrence
<i>Bettongia lesueur graii</i>	Boodie (inland), Burrowing Bettong (inland)	Extinct	EX	The Burrowing Bettong was once common over northern Australia but is now extinct (DoEE, 2017).	Will not Occur

EPBC Act Commonwealth Environment Protection and Biodiversity Conservation Act, 1999: EX Extinct, E Endangered, VU Vulnerable M Migratory

WC Act Western Australia Wildlife Conservation Act, 1950: Schedule 1, S2, S3, S4

Priority Species Department of Environment and Conservation's Priority Species List: Priority 1, P2, P3, P4, P5

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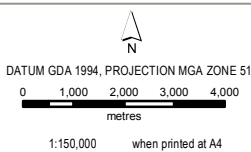
Survey Area

TEC PEC Search Results
 Vulnerable
 Priority 1
 Priority 3
 Priority 4

TPFL
 1
 3

WA Herb
 1
 3

Roads



Conservation Significant Flora and Communities - Desktop Results

Broome Asparagus

Biological Survey

Figure
4

Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

7.0 Field Survey Results

7.1 Vegetation

7.1.1 Threatened and Priority Ecological Communities

No Threatened or Priority communities were anticipated to occur in the survey area and none were recorded.

7.1.2 Vegetation Communities

Three vegetation communities were described and mapped from 957.31 ha of native vegetation within the survey area. All communities were open woodlands over a mix of tall shrubs. The grouping of quadrats was determined by the dominant grass species present. The relationship of quadrats is demonstrated in Figure 5. In BcApSp the *Sorghum plumosum* tussock grass prevailed, while CgApTc was dominated by SUBMIT – *Triodia caelestialis*. Trees, shrubs and herbs were consistent across the three vegetation communities, with slight variations in composition.

The topography of the survey area was homogenous, with all three communities recorded on flat terrain on red pindan soils.

The vegetation communities are described in detail, including the mapping code, survey effort, condition, and species richness in Table 14, and mapped on Figure 6.

Table 14 Vegetation communities recorded in the survey area described to plant community level including survey effort, photograph and species richness

Code	Vegetation Description	Additional Information	Photograph
BcApSp	Open woodland over <i>Acacia plectocarpa</i> tall shrub over <i>Sorghum</i> and <i>Triodia</i> mixed hummock and tussock grassland <i>Bauhinia cunninghamii</i>, <i>Corymbia greeniana</i>, <i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>, <i>Hakea macrocarpa</i> and <i>Ehretia saligna</i> var. <i>saligna</i> low open woodland over <i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>, <i>Ficus aculeata</i> var. <i>indecora</i>, <i>Flueggea virosa</i> subsp. <i>melanthesoides</i> and <i>Denhamia cunninghamii</i> tall open shrubland over <i>Corchorus sidoides</i> subsp. <i>sidoides</i>, <i>Carissa lanceolata</i>, <i>Waltheria indica</i>, <i>Melhania oblongifolia</i> and <i>Solanum cunninghamii</i> low sparse shrubland with <i>Sorghum plumosum</i>, <i>Aristida holathera</i> var. <i>holathera</i>, <i>Eriachne melicacea</i> and <i>Panicum effusum</i> tussock grassland with <i>Triodia caelestialis</i> (P3) open hummock grassland	Quadrats: 4, 5, 6, 10, 13, 14, 16, 17 Condition: Excellent Sp. Richness: 74 native species, one weed species. Area: 586.26 ha	
CgApTc	Open woodland over <i>Acacia plectocarpa</i> tall shrub over <i>Triodia</i> hummock grassland <i>Corymbia greeniana</i>, <i>Bauhinia cunninghamii</i>, <i>Brachychiton diversifolius</i>, <i>Psydrax pendulina</i> and <i>Hakea macrocarpa</i> mid open woodland over <i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>, <i>Flueggea virosa</i> subsp. <i>melanthesoides</i> and <i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393) mid to tall open shrubland over <i>Corchorus sidoides</i> subsp. <i>sidoides</i>, <i>Carissa lanceolata</i>, <i>Melhania oblongifolia</i> and <i>Waltheria indica</i> mid to low shrubland over <i>Triodia caelestialis</i> (P3) hummock grassland with <i>Spermacoce dolichosperma</i>, <i>Crotalaria medicaginea</i> var. <i>neglecta</i>, <i>Cucumis variabilis</i>, <i>Ptilotus polystachyus</i> and <i>Calandrinia quadrivalvis</i> low sparse herbland.	Quadrats: 2, 8, 9, 11, 12 Condition: Excellent Sp. Richness: 70 native species. Area: 308.66 ha	

Code	Vegetation Description	Additional Information	Photograph
EhAtTc	Sparse woodland over <i>Acacia tumida</i> tall shrub over <i>Triodia</i> hummock grassland with mix herbs. <i>Ehretia saligna</i> var. <i>saligna</i>, <i>Bauhinia cunninghamii</i>, <i>Corymbia greeniana</i> and <i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i> low sparse woodland over <i>Acacia tumida</i> var. <i>tumida</i> and <i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i> tall open shrubland over <i>Triodia caelestialis</i> (P3) with <i>Spermacoce dolichosperma</i>, <i>Glycine tomentella</i>, <i>Crotalaria brevis</i>, <i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i> and <i>Heliotropium leptaleum</i> low open herbland with <i>Corchorus sidoides</i> subsp. <i>sidoides</i>, <i>Waltheria indica</i>, <i>Acacia adoxa</i> var. <i>subglabra</i> and <i>Sida rohlenae</i> subsp. <i>occidentalis</i> low sparse shrubland.	Quadrats: 1, 3, 7, 15 Condition: Excellent Sp. Richness: 67 native species, one weed species. Area: 62.38 ha	

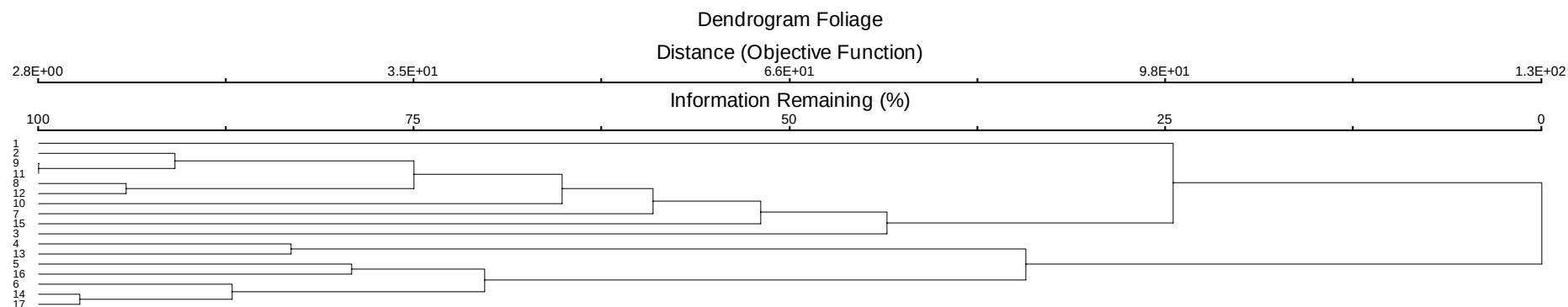
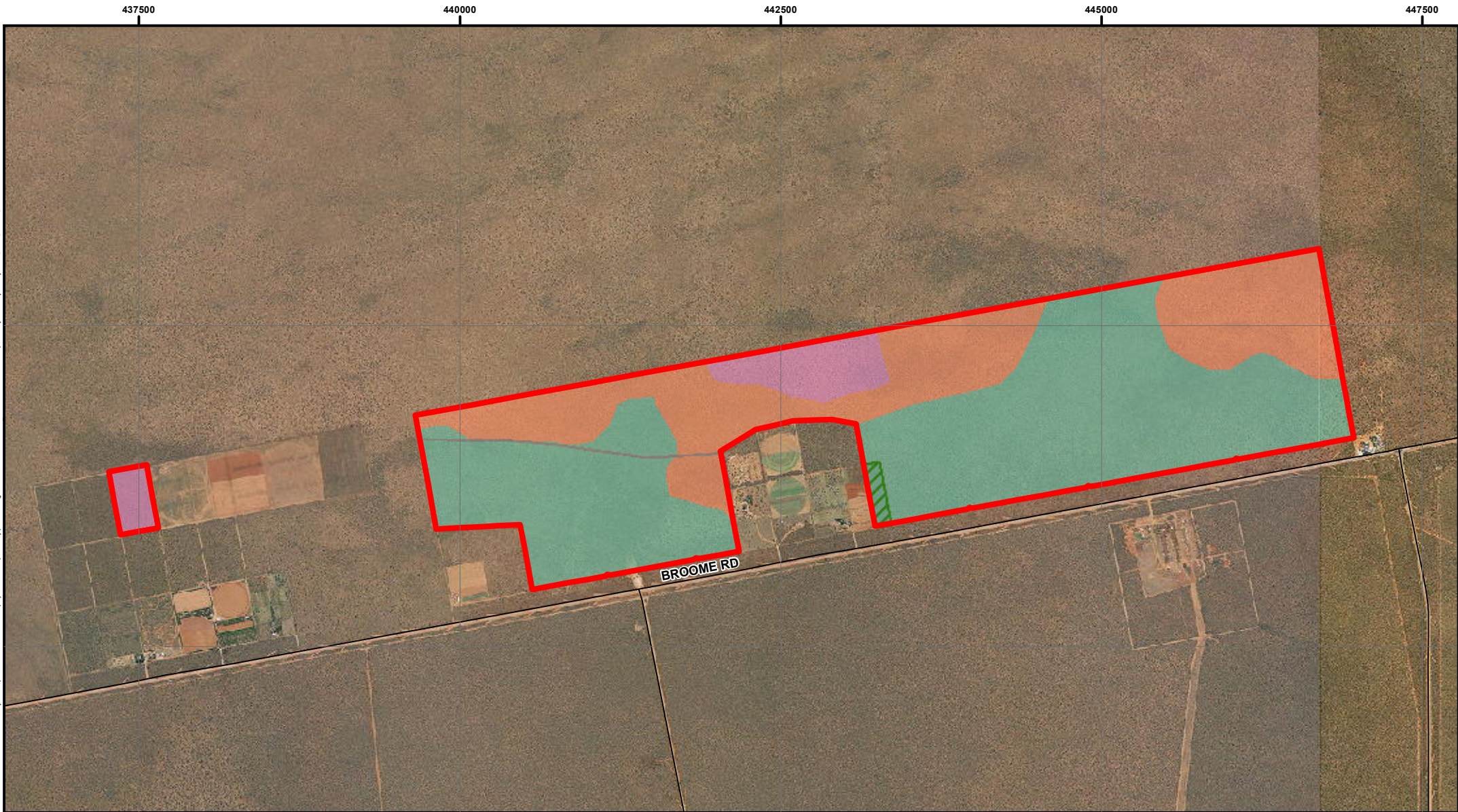
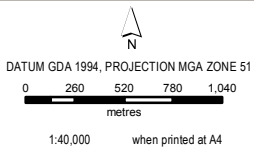


Figure 5 Dendrogram showing relationship of quadrats to one another using species composition

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LEGEND
Survey Area
Roads
Vegetation Community
BcApSp
CgApTc
EhAtTc
Cleared
Vegetation Condition (Excellent Unless Highlighted)
Very Good

Vegetation Community and Condition

Broome Asparagus

Biological Survey

Figure
6

Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

7.1.3 Vegetation Condition

Vegetation condition within the survey area was mostly recorded as 'Excellent'. There was one exception in an area directly adjacent to an existing farm. Historical aerial imagery indicates this had been previously cleared as part of the adjacent farm. This is now colonized by Sorghum species and shrubs and herbs have started to revegetate the area. Of the 957.31 ha of native vegetation, 951.16 ha is in 'Excellent' condition, with 6.15 ha recorded as 'Very Good' condition.

Condition mapping is shown on the vegetation map on Figure 6.

7.2 Flora

7.2.1 Threatened and Priority Flora

Two Priority species were recorded during the field survey, including *Triodia caelestialis* listed as Priority 3, and *Jacquemontia* sp. Broome listed as a Priority 1.

Jacquemontia sp. Broome (A.A. Mitchell 3028) was recorded in four quadrats, with individuals located in all three vegetation communities mapped within the survey area. This species is locally common in some patches, appearing to favour disturbed areas where it reproduces vegetatively. Three populations of *Jacquemontia* were recorded, with one comprising seven sub-populations.

This species appears to be locally common near the Broome townsite whilst being regionally restricted to this area. There are currently three known records from the Dampier peninsula, each representing one vouchered specimen. There is no additional population information on WA Herbarium, despite this species having been recorded a number of times in the local area during biological surveys for other projects, including Cape Leveque Road upgrade (Main Roads, 2013); James Price Point Access.

The species is easily recognisable with its showy mauve flowers and hairy creeping habit (Plate 1).

Table 15 *Jacquemontia* sp. Broome population information

Scale	Within survey area	Local	Regional
No. of populations	3	3	3
No. of individuals	365	No count data available	No count data available



Plate 1 *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (P1) habit and flower

Triodia caelestialis was the common hummock grass in all three communities. This species was recorded in all 17 quadrats, representing between 6-40% of understorey species composition (Appendix D). There are only two known populations on the Dampier Peninsula according to DBCA databases. However, it is likely that this species is locally common given its widespread and dominant status in the survey area. Lack of detailed surveys in the local area may lead to an underestimation of the extent of this species.

T. caelestialis has been recorded in Central Kimberley, Dampierland and Northern Kimberley. There are currently 24 vouchered specimens at the WA Herbarium. There is no information regarding population sizes or approximate number of individuals.

The size of the population in the survey area may be considered regionally and locally significant due to the large number of individuals, healthy status, and lack of records in the vicinity. However, it should be noted that this species was recorded extensively during other flora and vegetation assessments undertaken in the region. These may not have been vouchered specimens and hence DBCA do not have this data. The significance of the populations within this survey area may therefore be overestimated.

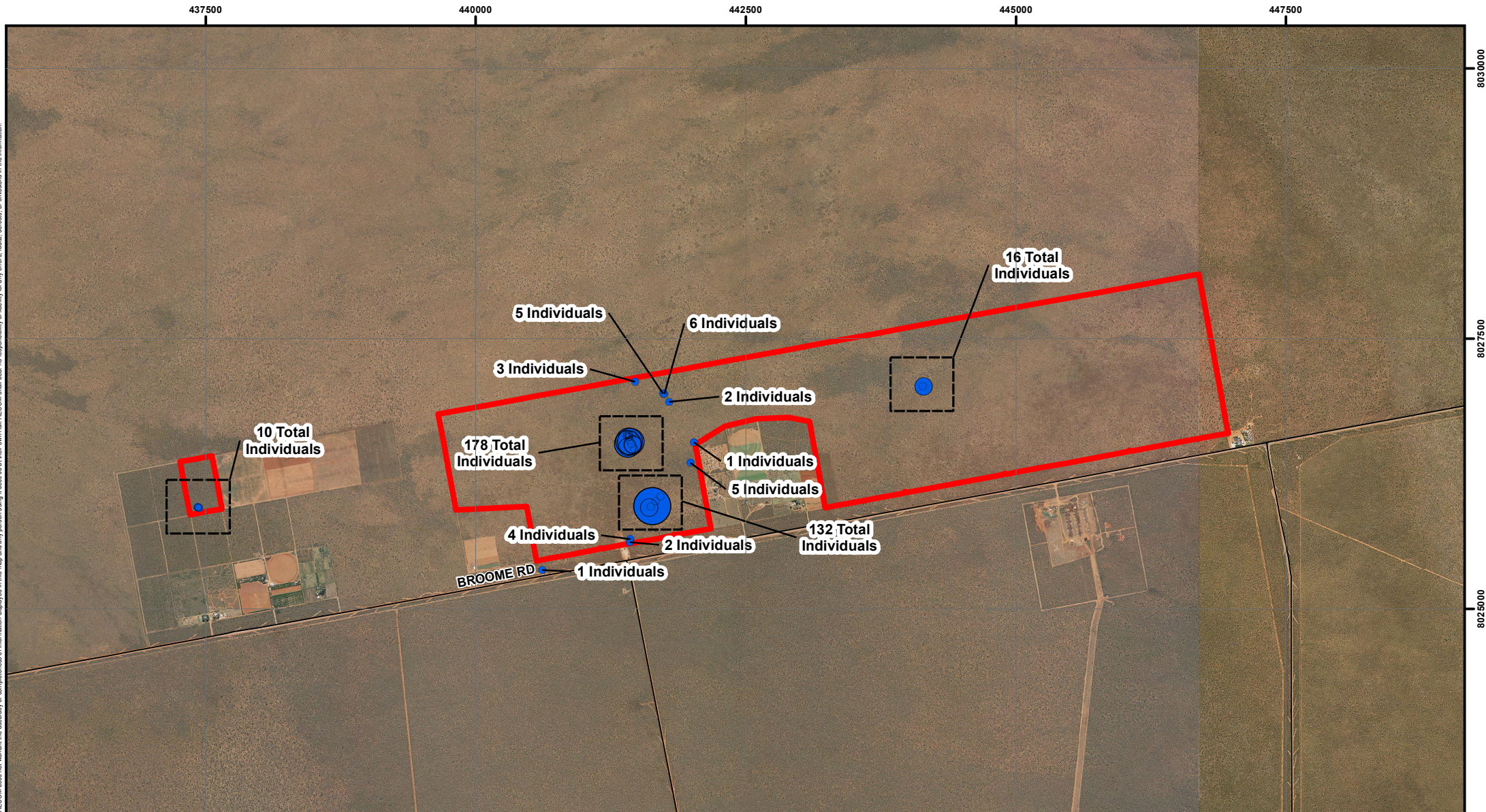
Table 16 *Triodia caelestialis* population information

Scale	Within survey area	Local	Regional
No. of populations	One (occupies entire survey area)	2	Unknown
No. of individuals	Not counted (~1000+)	0	Unknown



Plate 2 *Triodia caelestialis* (P3) habitat and habit

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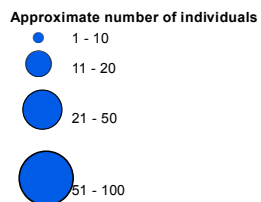
DATUM GDA 1994, PROJECTION MGA ZONE 51

0 320 640 960 1,280
metres

1:47,704 when printed at A4

LEGEND

- Survey Area
- ENV_GPS Priority Flora Cluster Count
- Roads



Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
***Jacquemontia* sp. Broome**

Broome Asparagus
Biological Survey

Figure
7

7.2.2 Inventory of Flora Species

A total of 91 species from 77 genera and 38 families were recorded within the survey area during the field assessment. The total includes 89 (98%) locally native species and two introduced (exotic) or naturalised weed species.

Families with the highest representation are Fabaceae (17 native taxa), Poaceae (10 native taxa), and Malvaceae (six native taxa). The full list of vascular flora species recorded and representative communities in which they occur in are presented in Appendix C. Qualitative data recorded from individual quadrats is presented in Appendix D.

The species area curve indicates that approximately 94 % of the total anticipated species were recorded and/or collected during the field survey (Figure 8). The predicted species richness is estimated using an asymptotic approach, using non parametric estimators that are universally valid for all species (Chao & Chiu 2016).

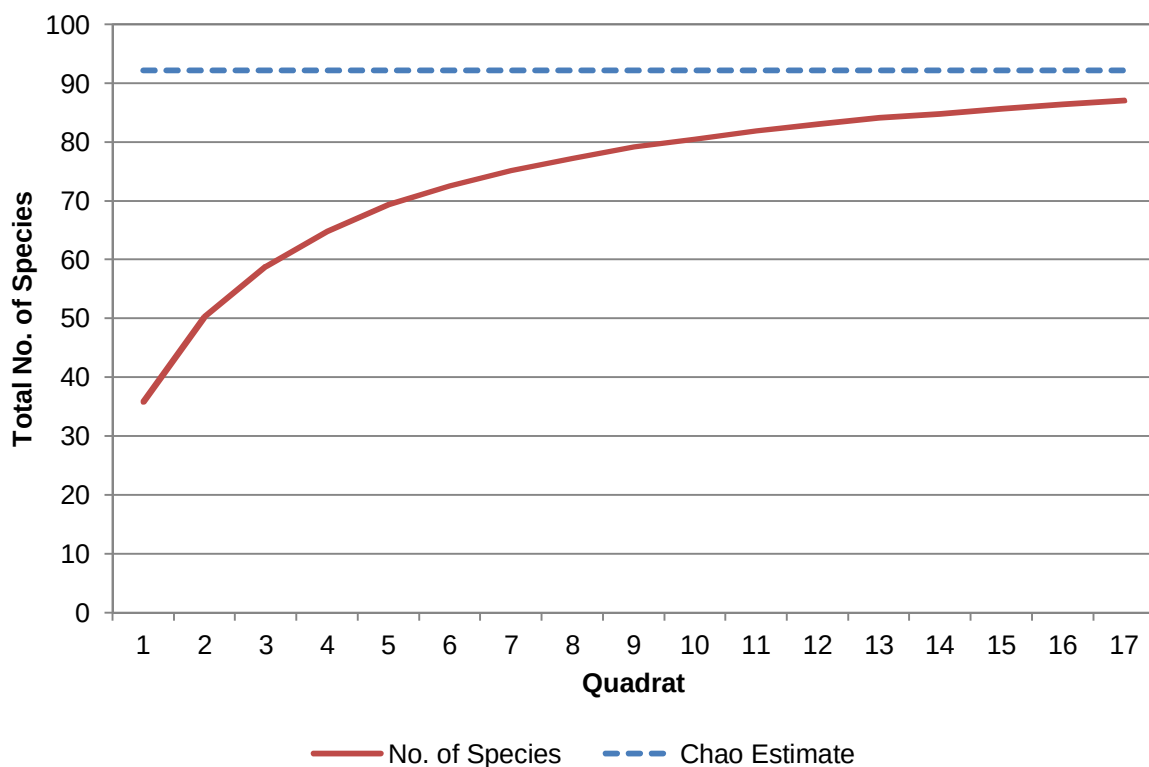


Figure 8 Species area curve of floristic dataset collected for the Broome Asparagus Project

7.2.3 Weed Species

Two weed species were recorded in the survey area. One of these was identified as *?Raphanus raphanistrum*. This species is from the Brassicaceae family and lacked suitable fruiting material for accurate identification. *R. raphanistrum* is known as Wild Radish, an annual herb that is found in disturbed areas around WA's southwest, and populated areas such as Broome and Kununurra.

The other weed species, *Setaria verticillata* was recorded in Quadrat 16 in low composition (<0.2 %). *S. verticillata* is a grass species that has scattered records throughout Australia's interior and some coastlines from Albany to Wyndham.

Neither of these weeds are listed as Declared Pests under the *Biosecurity and Agricultural Management Act 2007* (BAM Act).

7.3 Fauna and Fauna Habitat

7.3.1 Threatened, Migratory and Priority Fauna Species

The Greater Bilby was identified as occurring within the survey area through indirect evidence including diggings, scat and a potential old burrow (Section 7.3.1.1. and Figure 9). No direct sightings of the Greater Bilby were made.

The Rainbow Bee-eater, listed under the EPBC Act as Marine, was recorded and is anticipated to utilise all habitats within the survey area. Marine fauna is only considered to be Threatened when within Commonwealth land. It is, however, still listed under the WC Act as a bird that is protected under international agreements. DBCA are currently discussing the potential to maintain consistency with the EPBC Act listing and remove this bird from protection under the WC Act (G. Anderson, DBCA, pers. comm, July, 2017).

No other conservation significant fauna, including evidence of presence, was recorded during the field survey. However, this does not mean that they do not occur based on a five-day field survey. The Migratory Barn Swallow is expected to occur within the survey area between September and March. In addition, the following species may occur within the survey area:

- Fork-tailed Swift *Apus pacificus* (Migratory and IA)
- Letter-winged Kite *Elanus scriptus* (P4)
- Peregrine Falcon *Falco peregrinus* (OS)
- Spectacled Hare-wallaby (mainland) *Lagorchestes conspicillatus leichardti* (P3)
- *Lerista separanda* (P2)
- Princess Parrot *Polytelis alexandrae* (P4)
- Dampierland Burrowing Snake *Simoselaps minimus* (P2)
- Masked Owl (northern) *Tyto novae-hollandiae kimberli* (P1)
- Dampier Peninsula Goanna *Varanus sparnus*.(P1)

Of these, the Fork-tailed Swift, Letter-winged Kite, Peregrine Falcon, Masked Owl and Princess Parrot are highly mobile bird species and are not expected to rely specific habitat solely within the survey area. Prior to clearing activities, a pre-clearance survey is recommended to ensure none of these species are breeding in any hollows or nests within the survey area.

The Spectacled Hare-wallaby, *Lerista separanda*, Dampierland Burrowing Snake and Dampier Peninsula Goanna may occur within the Project area although were not recorded during the survey. A qualified fauna handler should be on hand for any clearing works to ensure that if these fauna are spotted, works can halt to allow relocation of these fauna to proceed.

7.3.1.1 Greater Bilby Results

Evidence

The Greater Bilby was identified through diggings, scat and an old burrow recorded within the survey area. The majority of this evidence was old and suggests that the Greater Bilby has not utilised this area in recent times. One digging was excavated recently (since last rain event). A two hectare search was undertaken around this 'fresh digging' and only one other potential digging was discovered. More fresh diggings would be expected within the search area to suggest that Greater Bilbies were in the area at the time of survey. The Greater Bilby is a highly mobile and nomadic species with the mean home range for males equating to 3.16km². There are usually many active and inactive burrow systems within the home range of this species (TSSC, 2016c). Based on the fact that no active or numerous inactive burrow systems were identified during the extensive fauna survey, no habitat within the survey area is likely to be within a home range of this species.

The lack of numerous fresh diggings within the search area suggests that the Greater Bilby perhaps moved through the area without constructing any burrow systems and at the time of the survey was

not present. No active burrows or other recent evidence of the Greater Bilby utilising the survey area was recorded. This evidence is detailed in Table 17.

Habitat

Greater Bilbies typically occupy three broad habitat types. Open tussock grassland on uplands and hills, *Acacia aneura* woodland/shrubland on ridges and hummock grassland in plains and alluvial areas (TSSC, 2016c). The Greater Bilby feeds on lepidopteran larvae, termites, ants, grasshoppers, spiders, beetles and also bulbs and fungi (TSSC, 2016c). The Greater Bilby is thought to enjoy eating the Witjuti grub and burrows are often found in conjunction with the outer shell of these grubs.

Within the survey area, the Open Woodland and *Acacia* Shrubland over Spinifex Hummock Grassland habitat type was considered to be suitable habitat for the Greater Bilby. Evidence of this species was recorded within the survey area during this survey and during the DER site visit (DER, 2017), therefore it can be said with certainty that the Greater Bilby occurs within this habitat type if this highly nomadic species were to venture through the survey area. The Open Woodland and *Acacia* Shrubland over Spinifex Hummock Grassland habitat makes up 369.60 ha (38.6%) of the survey area.

For further habitat details refer to Section 7.3.4.

Table 17 Evidence of the Greater Bilby within the survey area

Evidence type	Location (Latitude & Longitude)	Picture	Comments
Digging & scat	Grid 1 -17.85308395 122.40958264		A scat was identified next to this old digging that consisted of mostly dirt, a characteristic of Bilby scats. Digging was conical in shape.

Evidence type	Location (Latitude & Longitude)	Picture	Comments
Old burrow	Grid 3 -17.84716213 122.49493632		Very old potential burrow.
Digging	Grid 2 -17.85191597 122.41021145		Characteristic cylindrical digging following shrub to root system.

Evidence type	Location (Latitude & Longitude)	Picture	Comments
Digging	Grid 1 -17.85191597 122.41021145		Conical digging.

7.3.2 Inventory of Fauna Species

A total of 46 fauna species were recorded during the field survey. This included 35 birds, five mammals and six reptiles.

Table 18 Fauna species recorded within the survey area

Species	Common Name	Conservation Significance
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	Native
<i>Ardeotis australis</i>	Australian Bustard	Native
<i>Artamus cinereus</i>	Black-faced Woodswallow	Native
<i>Artamus personatus</i>	Masked Woodswallow	Native
<i>Cacatua roseicapilla</i>	Galah	Native
<i>Cacatua sanguinea</i>	Little Corella	Native
<i>Calyptorhynchus banksii macrorhynchus</i>	Northern Red-tailed Black Cockatoo	Native
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	Native
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Native
<i>Corvus bennetti</i>	Little Crow	Native
<i>Corvus orru</i>	Torresian Crow	Native
<i>Coturnix ypsilophora</i>	Brown Quail	Native
<i>Cracticus nigrogularis</i>	Pied Butcherbird	Native

Species	Common Name	Conservation Significance
<i>Falco berigora</i>	Brown Falcon	Native
<i>Gavicalis virescens</i>	Singing Honeyeater	Native
<i>Geopelia cuneata</i>	Diamond Dove	Native
<i>Geopelia humeralis</i>	Bar-shouldered Dove	Native
<i>Geopelia striata placida</i>	Peaceful Dove	Native
<i>Gerygone olivacea</i>	White-throated Gerygone	Native
<i>Grallina cyanoleuca</i>	Magpie-lark	Native
<i>Haliastur sphenurus</i>	Whistling Kite	Native
<i>Lichmera indistincta</i>	Brown Honeyeater	Native
<i>Macrotis lagotis</i>	Greater Bilby, dalgyte, ninu	Vulnerable under the EPBC Act and WC Act
<i>Malurus lamberti</i>	Variegated Fairy-wren	Native
<i>Manorina flavigula</i>	Yellow-throated Miner	Native
<i>Merops ornatus</i>	Rainbow Bee-eater	Marine under EPBC Act
<i>Milvus migrans</i>	Black Kite	Native
<i>Ocyphaps lophotes</i>	Crested Pigeon	Native
<i>Pachycephala rufiventris</i>	Rufous Whistler	Native
<i>Pardalotus striatus</i>	Striated Pardalote	Native
<i>Phaps chalcoptera</i>	Common Bronzewing	Native
<i>Poephila acuticauda</i>	Long-tailed Finch	Native
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	Native
<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird	Native
<i>Rhipidura leucophrys</i>	Willie Wagtail	Native
<i>Tachyglossus aculeatus acanthion</i>	Short-beaked Echidna	Native
<i>Taeniopygia bichenovii</i>	Double-barred Finch	Native
<i>Canis lupus</i>	Dog	Naturalised Exotic.
<i>Macropus robustus euro</i>	Euro	Native
<i>Notamacropus agilis nigrescens</i>	Agile Wallaby	Native
<i>Ctenotus inornatus</i>	Ctenotus inornatus	Native
<i>Diporiphora pindan</i>	Pindan Dragon	Native
<i>Heteronotia binoei</i>	Bynoe's Gecko	Native

Species	Common Name	Conservation Significance
<i>Menetia greyii</i>	Menetia greyii	Native
<i>Morethia ruficauda</i>	Morethia ruficauda subsp. Ruficauda	Native
<i>Pogona minor minor</i>	Western Bearded Dragon	Native

7.3.3 Introduced Species

One introduced species was recorded during the field survey and is listed below with its legal status under the BAM Act:

- Dog (*Canis lupus* subsp. *familiaris*) Domestic – Permitted – s11; Feral - Declared Pest – s22(2).

The term wild dog is used to describe dingoes (*Canis lupus dingo*), free-living domestic dogs (*Canis lupus familiaris*) and their hybrids. The presence of dingoes in Australia dates back to around 3,000 to 5,000 years ago (DAFWA, 2016). In WA, testing of wild dogs has suggested that approximately 59% of wild dogs are still pure dingoes. Wild dogs are considered to be opportunistic, generalist predators that can prey on a broad range of animals including livestock and an array of native animals. Effective wild dog control involves the integration of a diverse range of control techniques including trapping, shooting, fencings and 1080 baiting. Thus far, 1080 baiting appears to provide the most successful means of dog control on a broad scale. Given the ease of movement of wild dogs, effective control is difficult particularly in the Kimberley region where large tracts of land are managed by small numbers of people (DAFWA, 2016).

7.3.4 Fauna Habitat

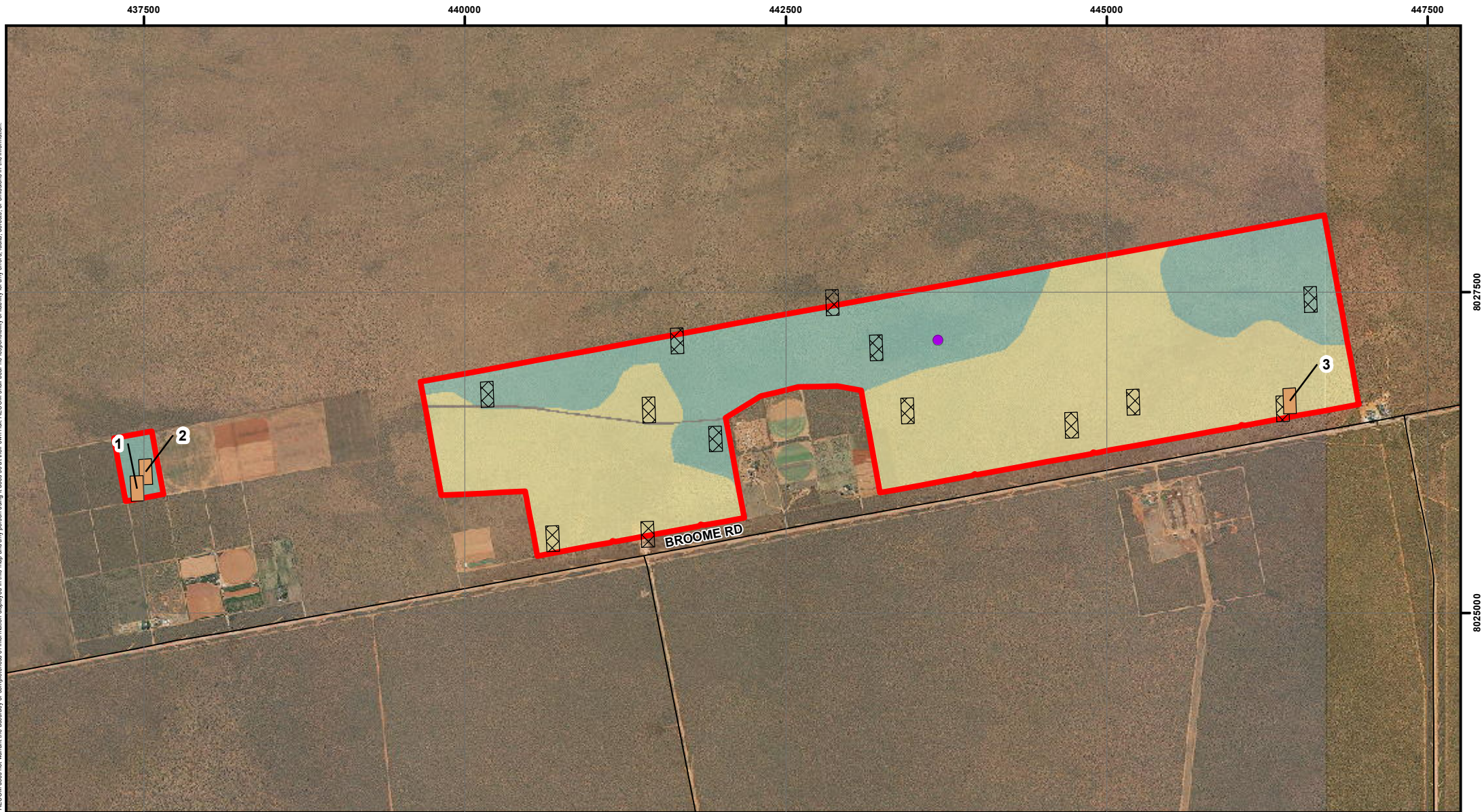
Three fauna habitats have been defined and mapped in the survey area based on the results of the field assessment (Table 19; Figure 9). These habitats are described above as:

- Open Woodland and *Acacia* Shrubland over Spinifex Hummock Grassland
- Open woodland over scattered *Acacia* shrubland and thick *Sorghum* Grassland
- Cleared sand/red loam tracks.

Table 19 Fauna Habitats of the Survey Area

Fauna Habitat	Description	Area (ha)	% of Survey area
Open Woodland and <i>Acacia</i> Shrubland over Spinifex Hummock Grassland	Sparse occasional trees and shrubs over relatively open spinifex hummocks on sandy/loamy soils. Suitable habitat for the Greater Bilby.	369.60	38.6
Open woodland over scattered <i>Acacia</i> shrubland and thick <i>Sorghum</i> Grassland	Sparse occasional trees and shrubs over thick <i>Sorghum plumosum</i> , choking out other grass species. On loamy/clay soil.	585.01	61.1
Cleared sand/red loam tracks	Cleared track, providing a movement corridor for larger species such as the Agile Wallaby and Dogs.	2.76	0.3
Total		957.4	100

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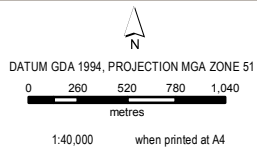
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LEGEND

- Survey Area
- Rainbow Bee-eater
- Roads
- Grid Search Areas
- Potential Bilby Evidence

Fauna Habitat

- Open Woodland and *Acacia* Shrubland over Spinifex Hummock Grassland
- Open woodland over scattered *Acacia* shrubland and thick *Sorghum* Grassland
- Cleared sand/red loam tracks



Data sources:
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Fauna Values of the Survey Area

Broome Asparagus

Biological Survey

Figure
9

8.0 Conclusions and Recommendations

In April, 2017 AECOM (Australia) Pty Ltd was commissioned to undertake biological assessments on behalf of Kimberley Asparagus Pty Ltd for a survey area incorporating 957 ha of native vegetation. The objective of the flora and vegetation, and fauna assessments included collating desktop information, undertaking field surveys to a suitable standard to support environmental approvals, completing targeted surveys for conservation significant flora and fauna, and documenting the results in a technical report. Meandering transects were walked throughout the survey area to document the flora, fauna and vegetation values.

In summary, the biological assessments identified:

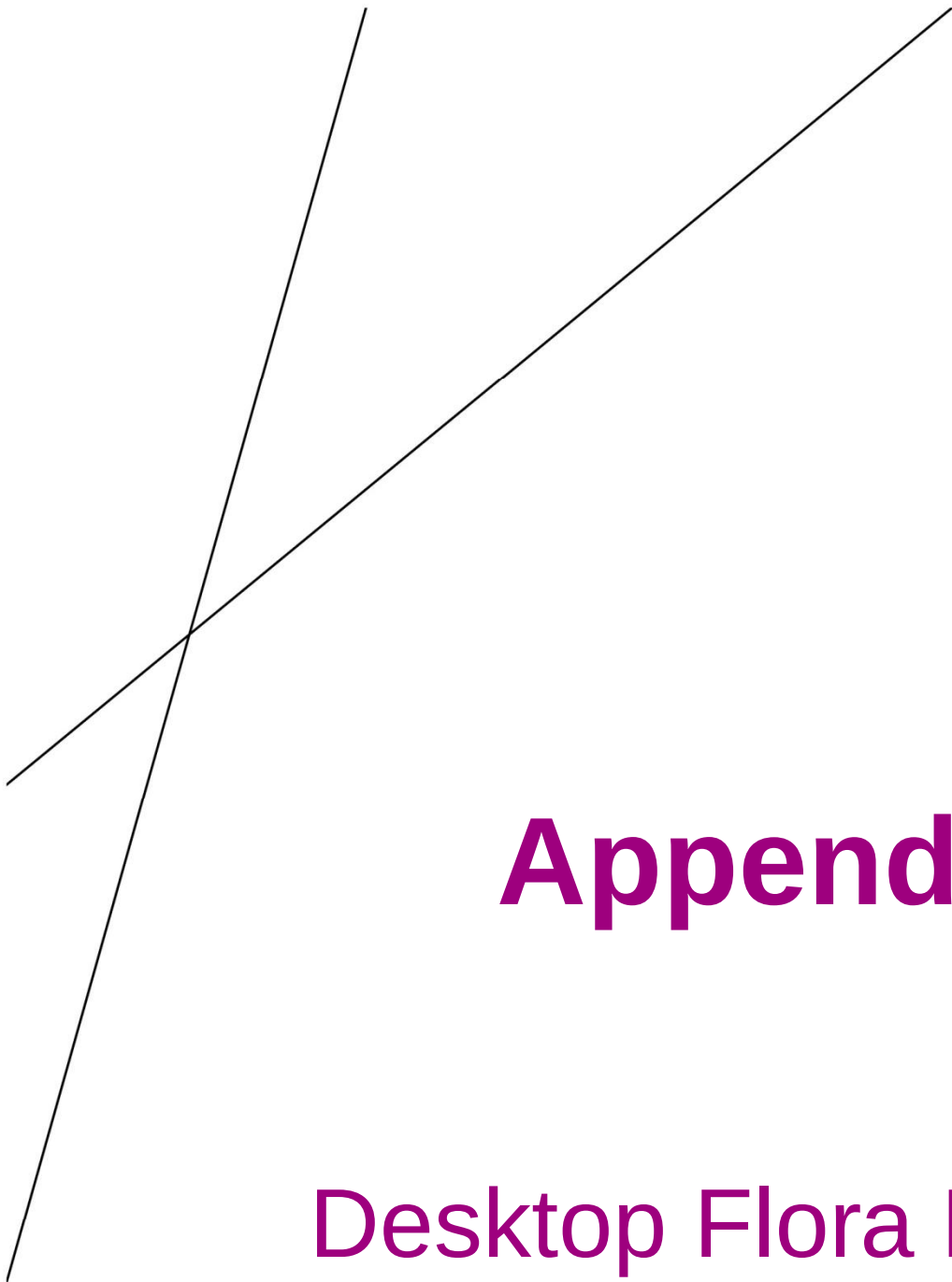
- No Priority or Ecological communities occur within or in close proximity to the survey area.
- Seven conservation significant flora species are considered likely to occur, of these two were recorded including *Triodia caelestialis* (P3) which represented the dominant Triodia hummock grass in the survey area, and *Jacquemontia* sp. Broome (P1). Populations for both species were extensively recorded within the survey area. They are likely to be regionally restricted to the Broome vicinity, however are considered locally common.
- Three vegetation communities were described and mapped, their differentiation based on the hummock and tussock grasses present.
- Evidence of the Greater Bilby was recorded including diggings, a scat and a potential old burrow. No direct evidence or recent evidence was found. This implies that the species would utilise the survey area if present in the local vicinity, however it is unlikely to be present at the time of the survey.
- Ten conservation significant fauna species are likely to occur or utilise habitat within the survey area, despite these not being recorded, including the Fork-tailed Swift *Apus pacificus*, Letter-winged Kite *Elanus scriptus*, Peregrine Falcon *Falco peregrinus*, Spectacled Hare-wallaby (mainland) *Lagorchestes conspicillatus leichardti*, *Lerista separanda*, Princess Parrot *Polytelis alexandrae*, Dampierland Burrowing Snake *Simoselaps minimus*, Masked Owl (northern) *Tyto novae-hollandiae kimberli*, and Dampier Peninsula Goanna *Varanus sparnus*.

No significant limitations were identified as affecting the biological assessments. Of note is the excellent survey season as a result of significant rainfall events in the months leading up to the field survey. This ensured that adequate flora identification material was available and fauna foraging was plentiful. The assessment was executed successfully with no time constraints, and no additional survey work is recommended.

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Appendix A

Desktop Flora Results

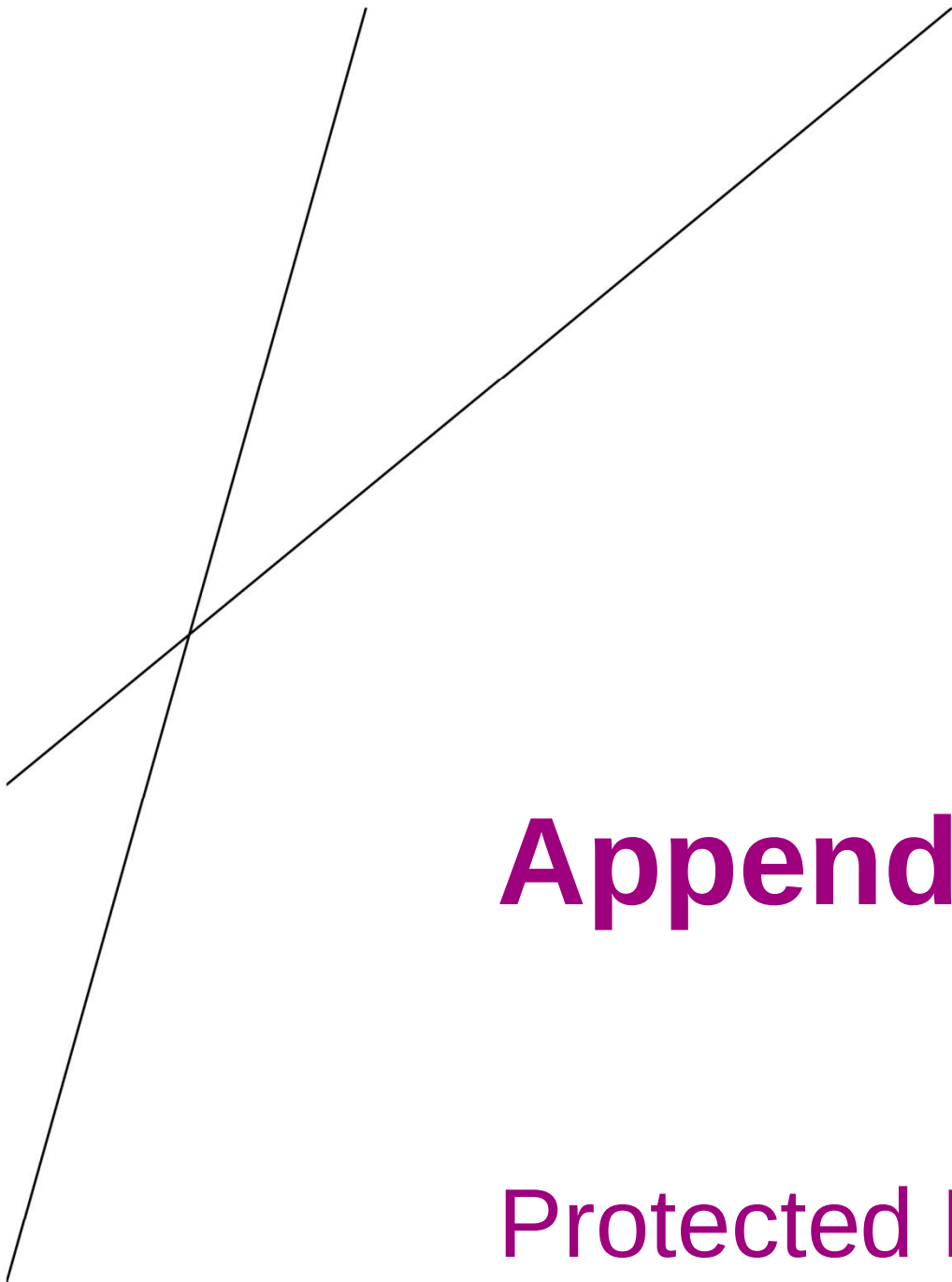
Appendix A Flora Desktop Results

Table 1 Threatened and Priority Flora that may occur in the survey area identified from database searches with descriptions sourced from Florabase (WAH 1998-)

Species	Conservation Code	Habitat	# of Records	Date Last Recorded	Flowering Period	Likelihood of Occurrence
<i>Acacia monticola</i> x <i>tumida</i> var. <i>kulparn</i>	P3	On exposed clifftop site	9	9/06/1983	Unknown	Unlikely
<i>Aphyllodium parvifolium</i>	P1	In greyish pindan soil, sand and sandhills.	2	3/04/1988	Apr, Jul	May
<i>Aphyllodium glossocarpum</i>	P3	Sand. Pindan.	1	12/06/1981	Apr-Oct	May
<i>Corymbia paractia</i>	P1	Skeletal soils in transition zone between coastal beach dunes and red pindan soils.	22	12/12/2015	Apr-May	Unlikely
<i>Croton aridus</i>	P3	Deep red sand, pindan soil. Sandplains or ridges, spinifex sandplains.	1	No date	August	May
<i>Decaisnina signata</i> subsp. <i>cardiophylla</i>	P1	Hemiparasitic on stems. On <i>Banksia dentata</i> (species restricted to skeletal soils over sandstone or quartzite, seasonally moist, includes rocky slopes, creeks and gorges).	3	No date	August	Unlikely
<i>Fuirena incrassata</i>	P3	On ironstone in grey sandy clay.	2	16/03/1986	May-Aug	Unlikely
<i>Glycine pindanica</i>	P3	Pindan, red sand.	20	09/02/2005	Jan, Feb	Likely
<i>Gomphrena pusilla</i>	P2	Behind foredune; fine beach sand.	3	02/06/1986	Mar-Apr, Jun	Unlikely
<i>Goodenia byrnesii</i>	P3	Orange Brown Silty sand.	3	09/04/2008	May, June	Unlikely
<i>Hibiscus kenneallyi</i>	P3	Coastal soils, sandstone.	1	08/03/1992	May-June	Unlikely
<i>Jacquemontia</i> sp. <i>Broome</i> (A.A. Mitchell 3028)	P1	Brown Orange Sand on Plain.	3	02/06/2011	Unknown	Likely

Species	Conservation Code	Habitat	# of Records	Date Last Recorded	Flowering Period	Likelihood of Occurrence
<i>Nicotiana heterantha</i>	P1	On seasonally wet black clay.	12	19/03/1998	May, June, Nov	Unlikely
<i>Nymphoides beaglensis</i>	P3	Edges of permanent waterholes or in seasonally inundated claypans and depressions.	3	28/03/1996	May-Aug	Unlikely
<i>Pandanus spiralis</i> var. <i>flammeus</i>	EPBC Act: E WC Act: EN	It is known from two populations occurring in the Edgar Ranges. Species grows in white and grey sand over sandstone and is restricted to a small, narrow gorge near waterholes.	1	No date	Feb-Aug	Unlikely
<i>Phyllanthus eremicus</i>	P3	Red Pindan and Sand.	4	10/04/2008	Aug-Oct	Likely
<i>Polymeria</i> sp. Broome (K.F. Kenneally 9759)	P1	Red pindan soil.	1	25/05/1986	Unknown	May
<i>Pterocaulon intermedium</i>	P3	Partly cleared pindan sandplain.	4	05/10/1993	Aug	May
<i>Pittosporum moluccanum</i>	P4	White sand. Sand dunes.	1	No date	Feb-Aug	Unlikely
<i>Schoenus punctatus</i>	P3	Watercourses.	1	04/04/2011	Aug	Unlikely
<i>Seringia exastia</i>	EPBC Act: CE WC Act: CR	Known from seven subpopulations within the Port of Broome area, occupying 0.04km ² . It grows on pindan (red soil) heathland.	17	10/04/2008	Mar-Aug	May
<i>Seringia katatona</i>	P3	Red sand.	4	20/05/2005	Apr, June-Oct	May
<i>Stylidium pindanicum</i>	P3	Clay flat.	3	07/05/2011	Unknown	May
<i>Terminalia kumpaja</i>	P3	Pindan, sandy.	5	18/10/1984	Unknown	Likely
<i>Tetragonia coronata</i>	P3	Cultivated pindan plain.	1	26/08/2003	July	Unlikely
<i>Thespidium basiflorum</i>	P1	Black soil with white sand.	2	15/06/1985	May-Aug	Unlikely
<i>Triodia acutispicula</i>	P3	Orange, silty sand.		28/08/2007	Jan-Apr	May
<i>Triodia caelestialis</i>	P3	Brown orange sand on plain.	3	02/06/2011	Unknown	Likely

Species	Conservation Code	Habitat	# of Records	Date Last Recorded	Flowering Period	Likelihood of Occurrence
<i>Tephrosia andrewii</i>	P1	Pindan Sand.	1	No date	Apr, Oct	Likely
<i>Tetragonia coronata</i>	P3	Red clay loam.	1	No date	Jul	Likely
<i>Tribulopsis marliesiae</i>	P3	No information available.	1	No date	Unknown	May

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Appendix B

Protected Matters
Search Results



EPBC Act Protected Matters Report

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

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: 05/05/17 15:09:51

[Summary](#)

[Details](#)

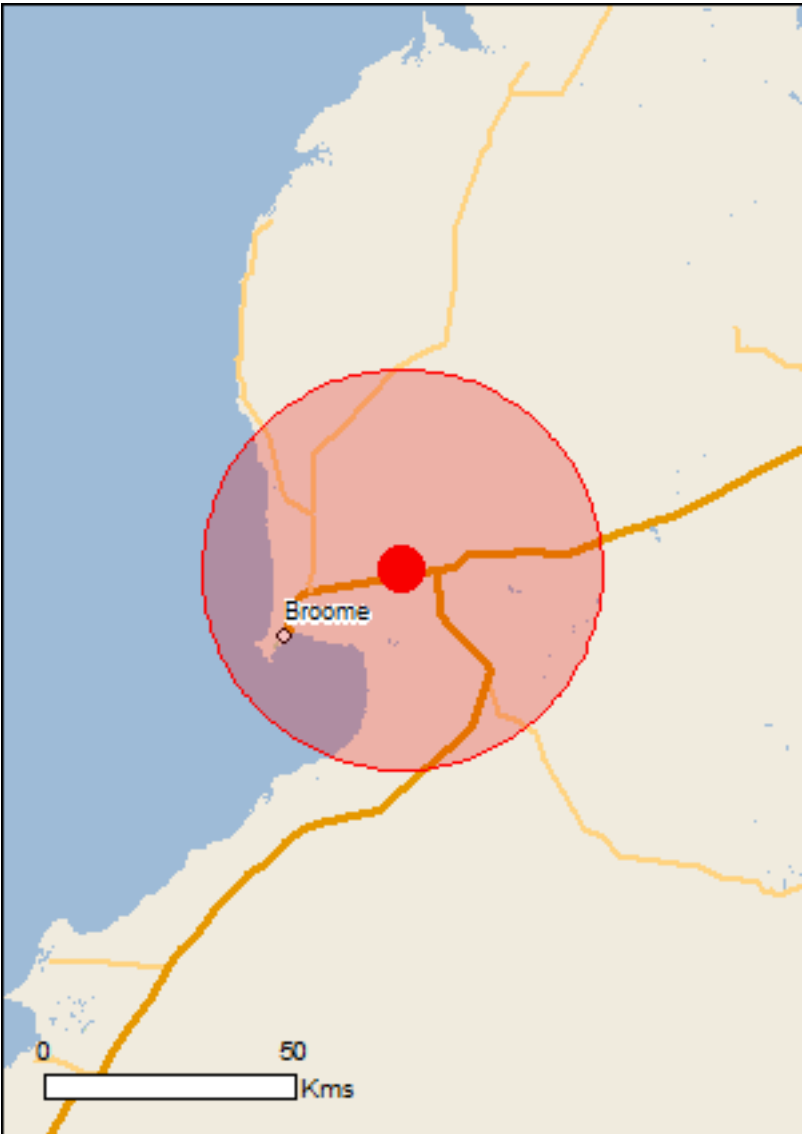
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 40.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	32
Listed Migratory Species:	63

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:	104
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	1

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	18
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar)		[Resource Information]
Name		Proximity
Roebuck bay		Within Ramsar site

Commonwealth Marine Area		[Resource Information]
Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.		

Name		
EEZ and Territorial Sea		

Marine Regions		[Resource Information]
If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.		

Name		
North-west		

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

Name	Status	Type of Presence
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Erythrura gouldiae Gouldian Finch [413]	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 known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Keraudrenia exastia Fringed Keraudrenia [66301]	Critically Endangered	Species or species habitat known to 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
Ctenotus angusticeps Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
within area		
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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 pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding 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 known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to 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 may 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 may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat 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 pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding 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]		Breeding known 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
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		habitat known to occur within area Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]	Critically Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]		Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]	Vulnerable	Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
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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
Commonwealth Land - Defence - BROOME TRAINING DEPOT

Listed Marine Species	[Resource Information]
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* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]	Vulnerable	Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		area Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area

Name	Threatened	Type of Presence
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to 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 known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within 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
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		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

Name	Threatened	Type of Presence
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 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 spinosissimus Hedgehog Seahorse [66239]		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
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]		Foraging, feeding or related behaviour known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur

Name	Threatened	Type of Presence
		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
Aipysurus tenuis Brown-lined Seasnake [1121]		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
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowellii null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Lapemis hardwickii Spine-bellied Seasnake [1113]		area 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 edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		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	Species or species habitat known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat 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]		Breeding known to 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 habitat may occur within area

Commonwealth Reserves Marine		[Resource Information]
Name	Label	
Roebuck	Multiple Use Zone (IUCN VI)	

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Broome Bird Observatory	WA
Broome Wildlife Centre	WA
Unnamed WA51046	WA
Unnamed WA51105	WA
Unnamed WA51162	WA
Unnamed WA51497	WA
Unnamed WA51583	WA
Unnamed WA51617	WA

Invasive Species[Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		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
Sus scrofa Pig [6]		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

Name	Status	Type of Presence
Dolichandra unguis-cati		habitat likely to occur within area
Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp.		
Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name		State
Roebuck Bay		WA
Roebuck Plains System		WA
Willie Creek Wetlands		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

-17.84899 122.44118

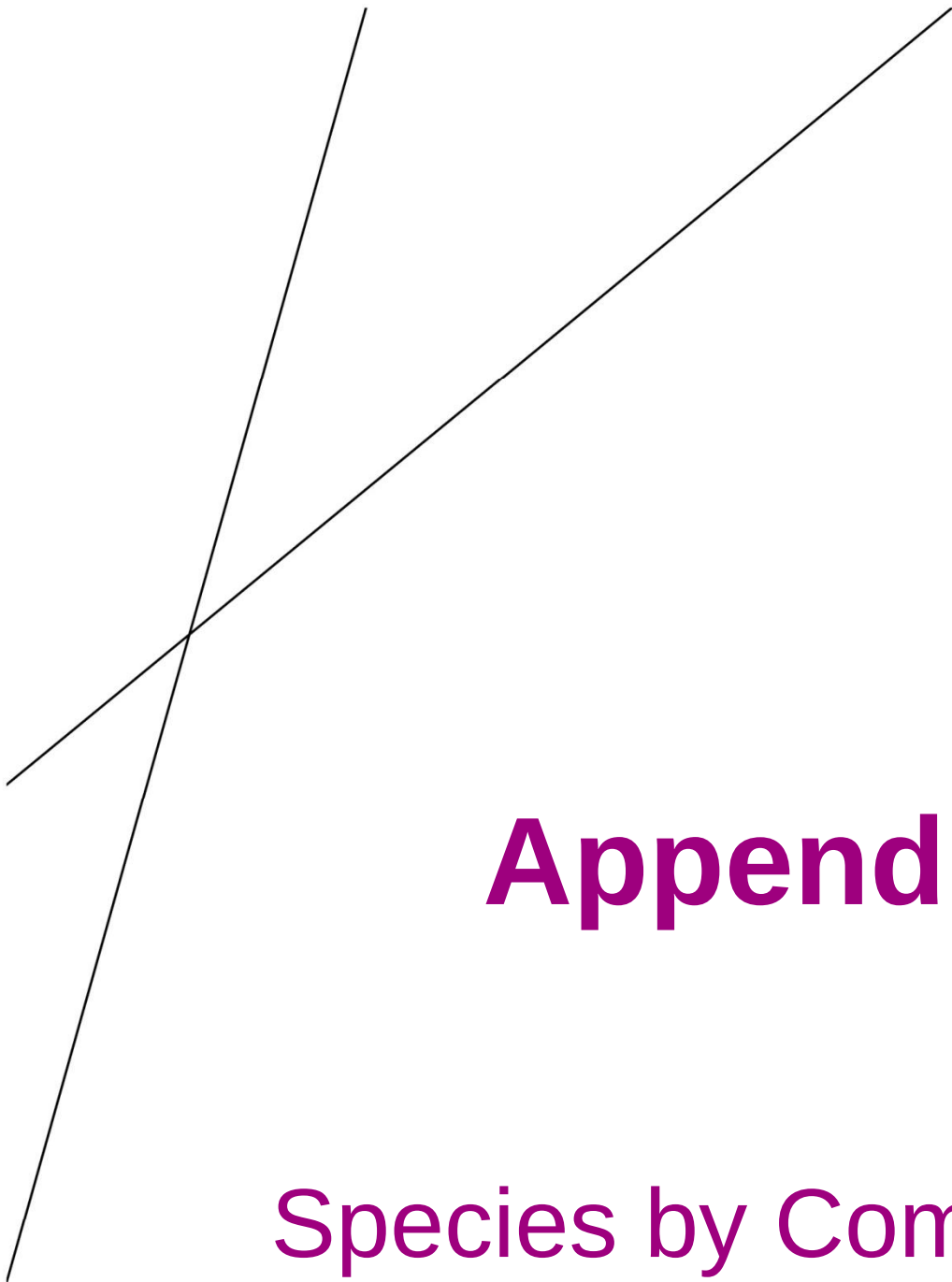
Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

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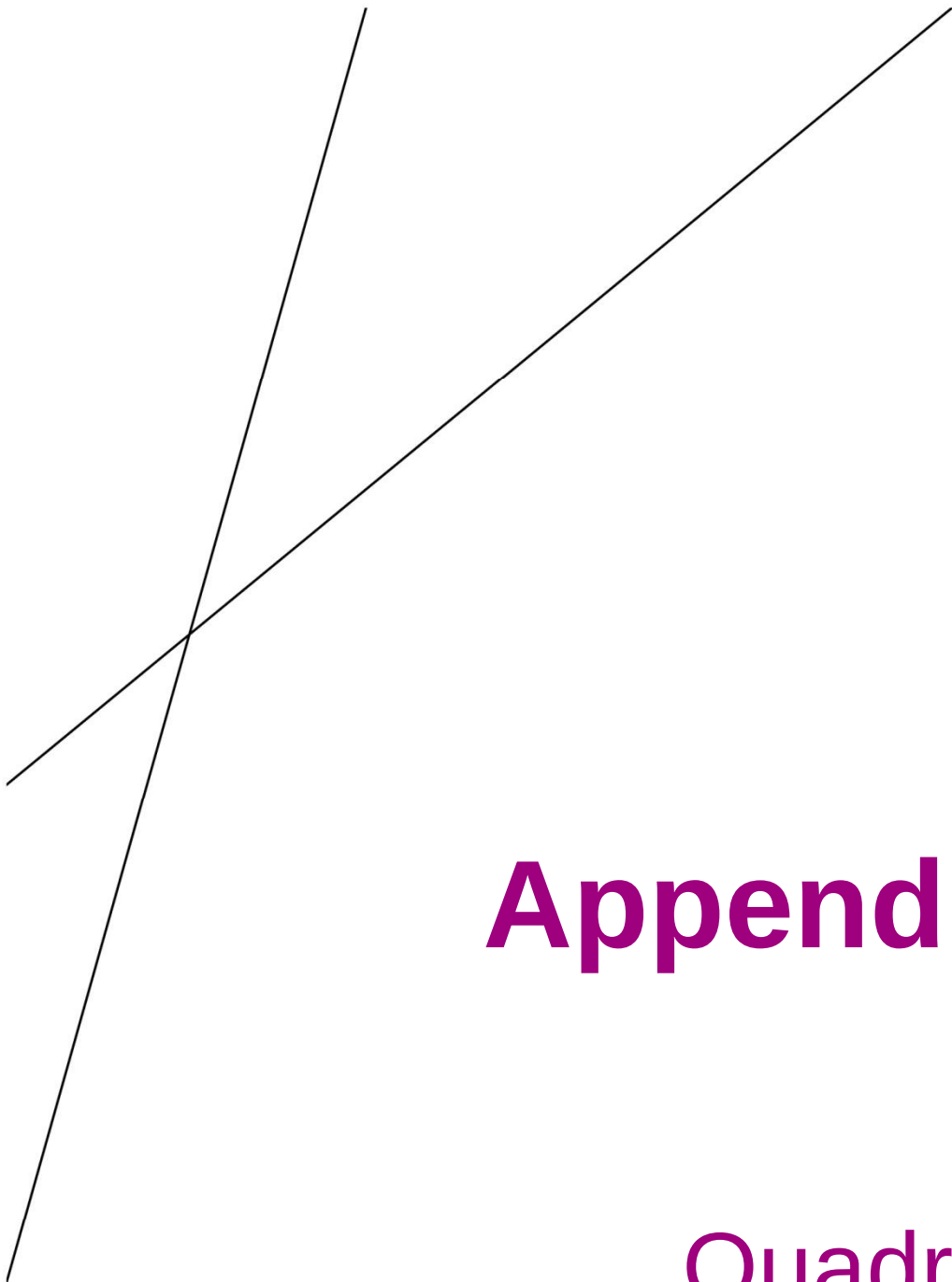
Appendix C

Species by Community Matrix

Appendix C Species by Community Matrix

Family	Taxon	BcApSp	CgApTc	EhAtTc
Aizoaceae				
	<i>Trianthema pilosum</i>	x	x	x
Amaranthaceae				
	<i>Ptilotus lanatus</i>	x	x	x
	<i>Ptilotus polystachyus</i>	x	x	x
Apocynaceae				
	<i>Carissa lanceolata</i>	x	x	x
	<i>Gymnanthera oblonga</i>	x	x	
Asteraceae				
	<i>Pterocaulon paradoxum</i>		x	x
	? <i>Pterocaulon serrulatum</i> (sterile juvenile)	x		x
Bignoniaceae				
	<i>Dolichandrone heterophylla</i>	x	x	x
Boraginaceae				
	<i>Ehretia saligna</i> var. <i>saligna</i>	x	x	x
	<i>Heliotropium leptaleum</i>	x	x	x
	<i>Trichodesma zeylanicum</i>			
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	x	x	x
Brassicaceae				
	? <i>Raphanus raphanistrum</i>			x
Caryophyllaceae				
	<i>Polycarpaea longiflora</i>	x	x	x
Celastraceae				
	<i>Denhamia cunninghamii</i>	x		
Combretaceae				
	<i>Terminalia volucris</i>	x		
Commelinaceae				
	<i>Murdannia graminea</i>	x	x	x
Convolvulaceae				
	<i>Bonamia media</i>	x	x	x
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	x	x	x
	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028) (P1)	x	x	x
	<i>Polymeria ambigua</i>	x	x	x
Cucurbitaceae				
	<i>Cucumis variabilis</i>		x	x
Cyperaceae				
	<i>Bulbostylis barbata</i>	x	x	
	<i>Euphorbiaceae</i>	x	x	
	<i>Euphorbia coghlanii</i>		x	
Fabaceae				
	<i>Acacia adoxa</i> var. <i>subglabra</i>	x	x	x
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	x	x	x
	<i>Acacia tumida</i> var. <i>tumida</i>	x	x	x
	<i>Bauhinia cunninghamii</i>	x	x	x
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	x	x	
	<i>Crotalaria brevis</i>	x	x	x
	<i>Crotalaria cunninghamii</i>			x
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	x	x	x
	<i>Crotalaria ramosissima</i>		x	
	<i>Cullen martinii</i>			
	<i>Erythrophleum chlorostachys</i>	x		
	<i>Glycine tomentella</i>	x	x	x
	<i>Indigofera linifolia</i>	x	x	
	<i>Indigofera linnaei</i>		x	
	<i>Senna costata</i>	x		x
	<i>Senna notabilis</i>		x	
	<i>Tephrosia remotiflora</i>	x	x	x
	<i>Zornia prostrata</i> var. <i>prostrata</i>	x		x
Goodeniaceae				
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	x	x	x
Gyrostemonaceae				
	<i>Codonocarpus cotinifolius</i>	x	x	x
	<i>Gyrostemon tepperi</i>	x		

Family	Taxon	BcApSp	CgApTc	EhAtTc
Hernandiaceae				
	<i>Gyrocarpus americanus</i>	x	x	x
Lamiaceae				
	<i>Premna acuminata</i>	x		x
Lauraceae				
	<i>Cassytha filiformis</i>		x	
Malvaceae				
	<i>Abutilon otocarpum</i>	x	x	x
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	x	x	x
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	x	x	x
	<i>Melhanina oblongifolia</i>	x	x	x
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	x	x	x
	<i>Waltheria indica</i>	x	x	x
Menispermaceae				
	<i>Tinospora smilacina</i>	x	x	x
Moraceae				
	<i>Ficus aculeata</i> var. <i>indecora</i>	x	x	x
Myrtaceae				
	<i>Corymbia flavescentis</i>	x		
	<i>Corymbia greeniana</i>	x		x
	<i>Corymbia ?polycarpa</i>	x	x	
	<i>Corymbia zygophylla</i>			x
Orobanchaceae				
	<i>Buchnera asperata</i>	x		
	<i>Buchnera ramosissima</i>	x	x	x
Phyllanthaceae				
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	x	x	x
	<i>Phyllanthus maderaspatensis</i>		x	
Poaceae				
	<i>Aristida holathera</i> var. <i>holathera</i>	x	x	x
	<i>Aristida hygrometrica</i>	x	x	x
	<i>Cymbopogon procerus</i>			x
	<i>Eragrostis eriopoda</i>	x		
	<i>Eriachne melicacea</i>	x	x	x
	<i>Grewia retusifolia</i>	x	x	x
	<i>Panicum effusum</i>	x	x	x
	* <i>Setaria verticillata</i>	x		
	<i>Sorghum plumosum</i>	x	x	
	<i>Triodia caelestialis</i> (P3)	x	x	x
	<i>Triodia</i> sp.	x		x
	<i>Yakirra australiensis</i>	x	x	x
Polygalaceae				
	<i>Polygala tepperi</i>	x	x	
Portulacaceae				
	<i>Portulaca oleracea</i>	x		
	<i>Calandrinia quadrivalvis</i>	x	x	x
Proteaceae				
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	x	x	x
	<i>Hakea macrocarpa</i>	x	x	x
Rhamnaceae				
	<i>Ventilago viminalis</i>	x	x	
Rubiaceae				
	<i>Gardenia pyrifolia</i> subsp. <i>keartlandii</i>	x		x
	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i>	x		x
	<i>Psydrax pendulina</i>	x	x	x
	<i>Spermacoce dolichosperma</i>	x	x	x
Sapindaceae				
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL 101393)	x	x	x
Solanaceae				
	<i>Solanum cunninghamii</i>	x	x	
Violaceae				
	<i>Hybanthus aurantiacus</i>	x	x	x
Zygophyllaceae				
	<i>Tribulus terrestris</i>		x	



Appendix D

Quadrat Data

Appendix D Quadrat Data from Broome Asparagus Flora and Vegetation Survey

Quadrat 1	Location: GDA 51K 437531 8026129	Date: 5/9/2017
Topography: Flat	Soils: Sand clay pindan	Colour: Red
Vegetation description: Sparse euc woodland over tall acacia shrub land over open low shrubland with tussock grasses		
Condition: Excellent		



*	Taxon	Height cm	Foliage %	Comments
	? <i>Pterocaulon serrulatum</i>	Pr	0.01	
*	? <i>Raphanus raphanistrum</i>	60	0.01	Dead
	<i>Abutilon otocarpum</i>	40	0.2	
	<i>Acacia adoxa</i> var. <i>subglabra</i>	40	0.5	
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	500	25	
	<i>Acacia tumida</i> var. <i>tumida</i>	400	2	
	<i>Bauhinia cunninghamii</i>	400	4	Mix shrubs

*	Taxon	Height cm	Foliage %	Comments
	<i>Bonamia media</i>	Pr	0.5	
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	200	0.3	
	<i>Buchnera ramosissima</i>	20	0.01	
	<i>Calandrinia quadrivalvis</i>			
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	4	
	<i>Corymbia greeniana</i>	600	5	
	<i>Crotalaria brevis</i>	30	1	
	<i>Cymbopogon procerus</i>	120	8	
	<i>Eriachne melicacea</i>			
	<i>Glycine tomentella</i>	Pr	2	
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	6	0.01	
	<i>Hakea macrocarpa</i>	400	2	
	<i>Heliotropium leptaleum</i>	30	0.5	
	<i>Melhania oblongifolia</i>	60	0.5	
	<i>Panicum effusum</i>	20	3	
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0.3	
	<i>Sorghum plumosum</i>			
	<i>Spermacoce dolichosperma</i>	20	3	
	<i>Grewia retusifolia</i>	120	1	
	<i>Ehretia saligna</i> var. <i>saligna</i>	150	1	
	<i>Gardenia pyrifolia</i> subsp. <i>keartlandii</i>	500	3	
	<i>Tephrosia remotiflora</i>	40	0.1	
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	80	0.5	
P3	<i>Triodia caelestialis</i> (P3)	150	40	
	<i>Waltheria indica</i>	60	1.5	
	<i>Yakirra australiensis</i>	30	2	

Note: * depicts an introduced (weed) species

Releve 2	Location: GDA 51K 441652 8027120	Date: 5/9/2017
Topography: Flat	Soils: Sand pindan	Colour: Orange
Vegetation description: Corymbia over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Acacia adoxa</i> var. <i>subglabra</i>	40	0.5
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	15
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	300	2
	<i>Calandrinia quadrivalvis</i>	10	0.01
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	
	<i>Corymbia greeniana</i>	600	6
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	30	0.1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	100	
	<i>Ehretia saligna</i> var. <i>saligna</i>	200	

*	Taxon	Height cm	Foliage %
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	250	
	<i>Melhania oblongifolia</i>	20	0.1
	<i>Panicum effusum</i>	20	1
	<i>Phyllanthus maderaspatensis</i>	30	0.5
	<i>Polycarpaea longiflora</i>	40	
	<i>Pterocaulon paradoxum</i>	40	
	<i>Sorghum plumosum</i>	220	
	<i>Spermacoce dolichosperma</i>	20	0.5
	<i>Trianthema pilosum</i>	Pr	0.2
P3	<i>Triodia caelestialis</i> (P3)	200	40
	<i>Waltheria indica</i>	30	

Note: * depicts an introduced (weed) species

Quadrat 3	Location: GDA 51K 442875 8028407	Date: 5/10/2017
Topography: Flat	Soils: Sand clay pindan	Colour: Red
Vegetation description: Low sparse wood, and over tall shrubland over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	500	30
	<i>Acacia tumida</i> var. <i>tumida</i>	300	1
	<i>Bauhinia cunninghamii</i>	50	0.1
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	300	4
	<i>Buchnera ramosissima</i>	40	0.01
	<i>Calandrinia quadrivalvis</i>	20	0.1
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	10	0.1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	20	0.1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.1
	<i>Cucumis variabilis</i>		0.02

*	Taxon	Height cm	Foliage %
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	150	3
	<i>Ehretia saligna</i> var. <i>saligna</i>	400	8
	<i>Eragrostis eriopoda</i>		
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	30	0.02
	<i>Glycine tomentella</i>	20	0.01
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	2	0.01
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	60	0.2
	<i>Heliotropium leptaleum</i>	20	0.1
	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i>	30	0.01
	<i>Panicum effusum</i>		
	<i>Polycarpaea longiflora</i>	30	0.1
	<i>Psydrax pendulina</i>	300	1
	<i>Pterocaulon paradoxum</i>	20	0.1
	<i>Ptilotus lanatus</i>	30	0.01
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	20	0.1
	<i>Spermacoce dolichosperma</i>	30	8
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	40	0.2
P3	<i>Triodia caelestialis</i> (P3)	130	30
	<i>Waltheria indica</i>	20	0.01
	<i>Waltheria indica</i>	50	0.2

Note: * depicts an introduced (weed) species

Quadrat 4	Location: GDA 51K 446317 8026603	Date: 5/10/2017
Topography: Flat	Soils: Sand clay pindan	Colour: Red
Vegetation description: Sparse woodland over sorghum over sparse shrubs		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	? <i>Pterocaulon serrulatum</i>		0.01
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	0.5
	<i>Bauhinia cunninghamii</i>	400	10
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	200	1
	<i>Calandrinia quadrivalvis</i>	15	0.01
	<i>Carissa lanceolata</i>	70	0.3
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	1
	<i>Corymbia greeniana</i>	1200	4
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	25	0.3
	<i>Denhamia cunninghamii</i>	200	0.2

*	Taxon	Height cm	Foliage %
	<i>Ehretia saligna</i> var. <i>saligna</i>	350	0.3
	<i>Eriachne melicacea</i>	20	1
	<i>Ficus aculeata</i> var. <i>indecora</i>	200	3
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	230	0.5
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	130	0.1
	<i>Gyrocarpus americanus</i>	100	0.1
	<i>Hakea macrocarpa</i>	500	1
	<i>Indigofera linifolia</i>	20	0.05
	<i>Melhania oblongifolia</i>	20	0.01
	<i>Melhania oblongifolia</i>	30	0.1
	<i>Polycarpaea longiflora</i>	25	0.01
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0.01
	<i>Solanum cunninghamii</i>	20	0.01
	<i>Sorghum plumosum</i>	240	30
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Grewia retusifolia</i>	170	0.5
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	30	0.01
	<i>Trianthema pilosum</i>		1
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	10	0.1
P3	<i>Triodia caelestialis</i> (P3)	160	6
	<i>Waltheria indica</i>	50	0.5

Note: * depicts an introduced (weed) species

Quadrat 5	Location: GDA 51K 444546 8026294	Date: 5/10/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Acacia shrubland over sorghum and triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %	Comments
	<i>Abutilon otocarpum</i>	40	0.1	
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	30	
	<i>Bauhinia cunninghamii</i>	200	0.5	
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	200	0.2	
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	450	1	
	<i>Calandrinia quadrivalvis</i>		0.01	
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	3	
	<i>Corymbia flavescens</i>	1000	0.5	Emergent
	<i>Corymbia greeniana</i>			Emergent
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.01	

*	Taxon	Height cm	Foliage %	Comments
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	100	0.5	
	<i>Dolichandrone heterophylla</i>	400	1	
	<i>Eragrostis eriopoda</i>	40	0.01	
	<i>Eriachne melicacea</i>	30	0.01	
	<i>Ficus aculeata</i> var. <i>indecora</i>	230	0.7	
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	160	0.7	
	<i>Glycine tomentella</i>	Pr	1	
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	2	0.01	
	<i>Grevillea refracta</i> subsp. <i>refracta</i>			Emerge
	<i>Gymnanthera oblonga</i>		0.3	
	<i>Hakea macrocarpa</i>	350	0.5	
	<i>Heliotropium leptaleum</i>	15	0.01	
	<i>Hybanthus aurantiacus</i>	20	0.01	
	<i>Melhania oblongifolia</i>	30	0.2	
	<i>Panicum effusum</i>	30	0.5	
	<i>Polycarpaea longiflora</i>	30	0.01	
	<i>Psydrax pendulina</i>	220	0.5	
	<i>Ptilotus polystachyus</i>	50	0.1	
	<i>Senna costata</i>			
	<i>Solanum cunninghamii</i>	25	0.05	
	<i>Sorghum plumosum</i>	240	25	
	<i>Spermacoce dolichosperma</i>	20	1	
	<i>Murdannia graminea</i>	40	0.01	
	<i>Gyrostemon tepperi</i>	40	0.5	
	<i>Trianthema pilosum</i>	Pr	0.2	
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	50	0.1	
P3	<i>Triodia caelestialis</i> (P3)	150	15	
	<i>Triodia</i> sp.	40	0.01	
	<i>Ventilago viminalis</i>	500	1	
	<i>Waltheria indica</i>	60	0.1	

Note: * depicts an introduced (weed) species

Quadrat 6	Location: GDA 51K 441423 8025612	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Acacia shrub over sorghum and triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %	Comments
	<i>Abutilon otocarpum</i>		0	Opp
	<i>Acacia adoxa</i> var. <i>subglabra</i>	30	1	
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	25	
	<i>Acacia tumida</i> var. <i>tumida</i>	80	0.02	
	<i>Aristida holathera</i> var. <i>holathera</i>	100	0.1	
	<i>Bauhinia cunninghamii</i>	400	2	
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	500	1	
	<i>Carissa lanceolata</i>	80	0.3	
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	40	5	
	<i>Corymbia ?polycarpa</i>	700	1	

*	Taxon	Height cm	Foliage %	Comments
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	50	0.5	
	<i>Cullen martinii</i>			In rehab adjacent to Q6
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	120	2	
	<i>Dolichandrone heterophylla</i>	240	0.2	
	<i>Eriachne melicacea</i>	30	0.1	
	<i>Eriachne melicacea</i>	30	2	
	<i>Glycine tomentella</i>		0.1	
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	5	0.01	
	<i>Hakea macrocarpa</i>	400	1	
P1	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)	30	0.05	Not in flower
	<i>Ptilotus polystachyus</i>	30	0.1	
	<i>Sorghum plumosum</i>	200	20	
	<i>Spermacoce dolichosperma</i>	20	0.5	
	<i>Murdannia graminea</i>	30	0.02	
	<i>Grewia retusifolia</i>	130	4	
	<i>Tinospora smilacina</i>		0.01	
	<i>Trianthema pilosum</i>		0.1	
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.02	
P3	<i>Triodia caelestialis</i> (P3)	150	20	
	<i>Waltheria indica</i>	40	0.05	

Note: * depicts an introduced (weed) species

Quadrat 7	Location: GDA 51K 437427 8025934	Date: 5/11/2017
Topography: Flat	Soils: Sand clay pindan	Colour: Orange
Vegetation description: Open woodland over acacia tall shrub over triodia and shrubs		
Condition: Excellent		



*	Taxon	Height cm	Foliage %	Comments
	<i>Bonamia media</i>		0.01	
	<i>Buchnera ramosissima</i>	70	0.01	
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	2	0.01	
	<i>Gyrocarpus americanus</i>	100	0.01	
	<i>Heliotropium leptaleum</i>	10	0.01	
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	20	0.01	
P1	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)	30	0.3	Vegetative
	<i>Triodia</i> sp.	30	0.02	
	<i>Dolichandrone heterophylla</i>	200	0.02	
	<i>Hybanthus aurantiacus</i>	20	0.02	

*	Taxon	Height cm	Foliage %	Comments
	<i>Pterocaulon paradoxum</i>	30	0.02	
	<i>Senna costata</i>	40	0.02	
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	0.05	
	<i>Yakirra australiensis</i>	20	0.1	
	<i>Crotalaria cunninghamii</i>	60	0.1	
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	20	0.1	
	<i>Spermacoe dolichosperma</i>	15	0.1	
	? <i>Corymbia greeniana</i>	400	0.2	
	<i>Aristida hygrometrica</i>	110	0.2	
	<i>Crotalaria brevis</i>	20	0.2	
	<i>Eriachne melicacea</i>	30	0.2	
	<i>Glycine tomentella</i>		0.2	
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	50	0.2	
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	220	0.3	
	<i>Acacia adoxa</i> var. <i>subglabra</i>	30	0.4	
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	450	0.5	
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	450	0.6	
	<i>Ehretia saligna</i> var. <i>saligna</i>	300	1	
	<i>Hakea macrocarpa</i>	200	1	
	<i>Waltheria indica</i>	40	1	
	<i>Melhanina oblongifolia</i>	40	1	
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	5	
	<i>Bauhinia cunninghamii</i>	400	5	
	<i>Corymbia greeniana</i>	700	5	
	<i>Acacia tumida</i> var. <i>tumida</i>	400	7	
P3	<i>Triodia caelestialis</i> (P3)	110	35	
	<i>Trichodesma zeylanicum</i>			

Note: * depicts an introduced (weed) species

Quadrat 8	Location: GDA 51K 440172 8026702	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall shrubland emergent euc over triodia over sparse shrub		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	600	3
	<i>Acacia tumida</i> var. <i>tumida</i>	250	0.2
	<i>Aristida hygrometrica</i>	70	2
	<i>Bauhinia cunninghamii</i>	450	3
	<i>Bonamia media</i>		0.91
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	300	0.1
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	400	2
	<i>Buchnera ramosissima</i>	110	0.01
	<i>Calandrinia quadrivalvis</i>	20	0.01
	<i>Carissa lanceolata</i>	180	0.5

*	Taxon	Height cm	Foliage %
	<i>Carissa lanceolata</i>	180	1
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	1
	<i>Corymbia ?polycarpa</i>	1000	0.5
	<i>Corymbia greeniana</i>	1000	2
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	50	1
	<i>Cucumis variabilis</i>		0.01
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	160	1
	<i>Ehretia saligna</i> var. <i>saligna</i>	160	0.03
	<i>Eriachne melicacea</i>	30	0.4
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	20	0.01
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	180	2
	<i>Glycine tomentella</i>		0.1
	<i>Hakea macrocarpa</i>	450	1
	<i>Heliotropium leptaleum</i>	30	0.01
	<i>Hybanthus aurantiacus</i>	40	0.01
P1	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)		0
	<i>Melhania oblongifolia</i>	30	0.1
	<i>Panicum effusum</i>	30	0.1
	<i>Phyllanthus maderaspatensis</i>	60	0.01
	<i>Polycarpaea longiflora</i>	30	0.02
	<i>Psydrax pendulina</i>	250	1.5
	<i>Pterocaulon paradoxum</i>	40	0.01
	<i>Ptilotus lanatus</i>	20	0.01
	<i>Ptilotus polystachyus</i>	25	0.02
	<i>Senna notabilis</i>		0
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Murdannia graminea</i>	30	0.01
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	30	0.01
	<i>Trianthema pilosum</i>		0.01
	<i>Tribulus terrestris</i>		0.01
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.02
P3	<i>Triodia caelestialis</i> (P3)	130	30
	<i>Waltheria indica</i>	60	0.2
	<i>Yakirra australiensis</i>	15	0.02

Note: * depicts an introduced (weed) species

Quadrat 9	Location: GDA 51K 440932 8026660	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall acacia shrubland over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Aristida holathera</i> var. <i>holathera</i>	130	0.3
	<i>Bauhinia cunninghamii</i>	500	3
	<i>Bonamia media</i>		0.01
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	600	3
	<i>Calandrinia quadrivalvis</i>	10	0.01
	<i>Carissa lanceolata</i>	150	3
	<i>Codonocarpus cotinifolius</i>	200	0.4
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	2
	<i>Corymbia greeniana</i>	800	1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.3

*	Taxon	Height cm	Foliage %
	<i>Cucumis variabilis</i>		0.03
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	170	3
	<i>Ehretia saligna</i> var. <i>saligna</i>	180	0.2
	<i>Eriachne melicacea</i>		
	<i>Euphorbia coghlanii</i>	5	0.01
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	15	0.01
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	5	0.01
	<i>Gymnanthera oblonga</i>		0.01
	<i>Hakea macrocarpa</i>	350	1
	<i>Hybanthus aurantiacus</i>	40	0.01
	<i>Melhania oblongifolia</i>	40	1
	<i>Panicum effusum</i>	20	0.2
	<i>Polycarpha longiflora</i>	30	0.01
	<i>Psydrax pendulina</i>	380	5
	<i>Ptilotus lanatus</i>	40	0.05
	<i>Ptilotus polystachyus</i>	40	0.05
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	20	0.01
	<i>Sorghum plumosum</i>	220	0.1
	<i>Spermacoe dolichosperma</i>	20	0.2
	<i>Murdannia graminea</i>	30	0.01
	<i>Grewia retusifolia</i>	220	0.5
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	20	0.01
	<i>Tephrosia remotiflora</i>	100	0.02
	<i>Trianthema pilosum</i>		0.02
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.02
P3	<i>Triodia caelestialis</i> (P3)	140	35
	<i>Waltheria indica</i>	50	0.1
	<i>Yakirra australiensis</i>	25	0.1

Note: * depicts an introduced (weed) species

Quadrat 10	Location: GDA 51K 441432 8026581	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Acacia shrubland over triodia with low shrubs		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Aristida holathera</i> var. <i>holathera</i>	100	0.5
	<i>Bauhinia cunninghamii</i>	400	2
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	400	0.2
	<i>Calandrinia quadrivalvis</i>	10	0.02
	<i>Codonocarpus cotinifolius</i>	180	0.5
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	2
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	50	0.5
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	180	3
	<i>Ehretia saligna</i> var. <i>saligna</i>	200	1

*	Taxon	Height cm	Foliage %
	<i>Eriachne melicacea</i>	40	0.5
	<i>Ficus aculeata</i> var. <i>indecora</i>	160	0.2
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	5	0.01
	<i>Gymnanthera oblonga</i>		0.01
	<i>Gyrocarpus americanus</i>	200	0.05
	<i>Hakea macrocarpa</i>	250	0.3
	<i>Hybanthus aurantiacus</i>	40	0.02
P1	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)	30	1
	<i>Melhania oblongifolia</i>	40	1
	<i>Panicum effusum</i>	30	0.2
	<i>Polycarpaea longiflora</i>	20	0.01
	<i>Polygala tepperi</i>	30	0.01
	<i>Ptilotus lanatus</i>	40	0.01
	<i>Ptilotus polystachyus</i>	40	0.03
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0.01
	<i>Solanum cunninghamii</i>	40	0.01
	<i>Sorghum plumosum</i>	200	2
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Murdannia graminea</i>	20	0.01
	<i>Grewia retusifolia</i>	140	1
	<i>Gardenia pyriformis</i> subsp. <i>keartlandii</i>	250	0.3
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	20	0.01
	<i>Trianthema pilosum</i>		
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	70	0.1
P3	<i>Triodia caelestialis</i> (P3)	140	30
	<i>Triodia</i> sp.	30	0.01
	<i>Ventilago viminalis</i>	300	0.5
	<i>Waltheria indica</i>	50	0.1

Note: * depicts an introduced (weed) species

Quadrat 11	Location: GDA 51K 441952 8026356	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall acacia shrubland over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Calandrinia quadrivalvis</i>	10	0.01
	<i>Codonocarpus cotinifolius</i>	180	0.3
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	1
	<i>Corymbia greeniana</i>	1000	4
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	50	0.2
	<i>Cucumis variabilis</i>		0.91
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	140	1
	<i>Dolichandrone heterophylla</i>	150	0.5
	<i>Ehretia saligna</i> var. <i>saligna</i>	150	1
	<i>Eriachne melicacea</i>	30	0.1

*	Taxon	Height cm	Foliage %
	<i>Ficus aculeata</i> var. <i>indecora</i>	100	0.2
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	170	0.4
	<i>Glycine tomentella</i>		0.01
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	2	0.01
	<i>Hakea macrocarpa</i>	250	0.1
	<i>Heliotropium leptaleum</i>		
P1	<i>Jacquemontia</i> sp. Broome (A.A. Mitchell 3028)		
	<i>Melhania oblongifolia</i>	40	0.04
	<i>Panicum effusum</i>	20	0.4
	<i>Phyllanthus maderaspatensis</i>	10	0.01
	<i>Polycarpaea longiflora</i>	20	0.01
	<i>Polygala tepperi</i>	40	0.01
	<i>Psydrax pendulina</i>	300	0.5
	<i>Ptilotus polystachyus</i>	30	0.02
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0.05
	<i>Solanum cunninghamii</i>	30	0.02
	<i>Sorghum plumosum</i>	220	0.2
	<i>Spermacoce dolichosperma</i>	10	3
	<i>Polymeria ambigua</i>		0.01
	<i>Murdannia graminea</i>	30	0.01
	<i>Grewia retusifolia</i>	130	0.5
	<i>Tephrosia remotiflora</i>	40	0.1
	<i>Tinospora smilacina</i>		0.01
	<i>Tribulus terrestris</i>		0.01
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.02
P3	<i>Triodia caelestialis</i> (P3)	140	35
	<i>Ventilago viminalis</i>	200	0.2
	<i>Waltheria indica</i>	40	0.4
	<i>Yakirra australiensis</i>	30	0.5

Note: * depicts an introduced (weed) species

Quadrat 12	Location: GDA 51K 446588 8027441	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Open corymbia woodland over acacia over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Calandrinia quadrivalvis</i>	20	0.01
	<i>Carissa lanceolata</i>	140	0.3
	<i>Cassytha filiformis</i>		0
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	2
	<i>Corymbia greeniana</i>	1200	8
	<i>Crotalaria brevis</i>	20	0.2
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	1
	<i>Crotalaria ramosissima</i>	20	0
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	130	2
	<i>Dolichandrone heterophylla</i>	300	0.2

*	Taxon	Height cm	Foliage %
	<i>Ehretia saligna</i> var. <i>saligna</i>	200	0.1
	<i>Eriachne melicacea</i>	20	0
	<i>Ficus aculeata</i> var. <i>indecora</i>	130	0.2
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	250	0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	3	0.01
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	300	0.2
	<i>Gyrocarpus americanus</i>	100	0.1
	<i>Hakea macrocarpa</i>	200	0.3
	<i>Heliotropium leptaleum</i>	30	0.01
	<i>Hybanthus aurantiacus</i>	40	0.01
	<i>Indigofera linifolia</i>	20	0.01
	<i>Indigofera linnaei</i>	25	0
	<i>Melhania oblongifolia</i>	50	0.05
	<i>Panicum effusum</i>	30	0.2
	<i>Phyllanthus maderaspatensis</i>	20	0.01
	<i>Ptilotus polystachyus</i>	80	0.1
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0
	<i>Solanum cunninghamii</i>	30	0.01
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Polymeria ambigua</i>		0.01
	<i>Clerodendrum tomentosum</i> var. <i>mollissima</i>	400	0
	<i>Murdannia graminea</i>	40	0.01
	<i>Tinospora smilacina</i>		0.01
	<i>Trianthema pilosum</i>		0.1
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.02
P3	<i>Triodia caelestialis</i> (P3)	150	35
	<i>Ventilago viminalis</i>	200	0.1
	<i>Waltheria indica</i>	50	0.3
	<i>Yakirra australiensis</i>	20	0.5

Note: * depicts an introduced (weed) species

Quadrat 13	Location: GDA 51K 446468 8026756	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Open corymbia woodland over sorghum		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Calandrinia quadrivalvis</i>	15	0.01
	<i>Carissa lanceolata</i>	120	1
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	0.02
	<i>Corymbia greeniana</i>	1200	10
	<i>Crotalaria brevis</i>		
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.1
	<i>Ehretia saligna</i> var. <i>saligna</i>	220	0.1
	<i>Erythrophleum chlorostachys</i>	500	1
	<i>Ficus aculeata</i> var. <i>indecora</i>	170	0.2
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	150	0.2

*	Taxon	Height cm	Foliage %
	<i>Glycine tomentella</i>		0.2
	<i>Hakea macrocarpa</i>	400	2
	<i>Melhania oblongifolia</i>	40	0.01
	<i>Panicum effusum</i>	30	0.2
	<i>Polycarpaea longiflora</i>	20	0.01
	<i>Ptilotus polystachyus</i>	40	0.04
	<i>Senna costata</i>	100	0.02
	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	30	0.01
	<i>Solanum cunninghamii</i>	40	0.01
	<i>Sorghum plumosum</i>	250	25
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Polymeria ambigua</i>		0.01
	<i>Murdannia graminea</i>	20	0.01
	<i>Grewia retusifolia</i>	170	0.2
	<i>Trianthema pilosum</i>		0.5
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	20	0.01
P3	<i>Triodia caelestialis</i> (P3)	150	20
	<i>Ventilago viminalis</i>	100	0.1
	<i>Waltheria indica</i>	50	0.5

Note: * depicts an introduced (weed) species

Quadrat 14	Location: GDA 51K 445573 8026433	Date: 5/11/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall shrubland over sorghum amd triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Calandrinia quadrivalvis</i>	10	0.01
	<i>Carissa lanceolata</i>	180	1
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.2
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	120	0.3
	<i>Ehretia saligna</i> var. <i>saligna</i>	300	0.2
	<i>Eriachne melicacea</i>	20	0.1
	<i>Erythrophleum chlorostachys</i>	600	4
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	20	0.03

*	Taxon	Height cm	Foliage %
	<i>Ficus aculeata</i> var. <i>indecora</i>	250	2
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	160	0.2
	<i>Glycine tomentella</i>		0.01
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	4	0.01
	<i>Gymnanthera oblonga</i>		0.01
	<i>Hakea macrocarpa</i>	200	0.2
	<i>Hybanthus aurantiacus</i>	40	0.01
	<i>Melhania oblongifolia</i>	50	0.02
	<i>Polycarpaea longiflora</i>	30	0.01
	<i>Psydrax pendulina</i>	100	0.03
	<i>Ptilotus polystachyus</i>	40	0.05
	<i>Solanum cunninghamii</i>	30	0.03
	<i>Sorghum plumosum</i>	250	30
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Grewia retusifolia</i>	140	0.2
	<i>Gyrostemon tepperi</i>	60	0.02
	<i>Trianthema pilosum</i>		0.1
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	30	0.01
P3	<i>Triodia caelestialis</i> (P3)	130	20
	<i>Waltheria indica</i>	40	0.05

Note: * depicts an introduced (weed) species

Quadrat 15	Location: GDA 51K 443204 8027065	Date: 5/12/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall acacia shrubland over triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Calandrinia quadrivalvis</i>	15	0.01
	<i>Carissa lanceolata</i>	200	0.2
	<i>Codonocarpus cotinifolius</i>	200	0.1
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	0.5
	<i>Corymbia greeniana</i>	500	0.2
	<i>Corymbia zygophylla</i>	300	0.2
	<i>Crotalaria brevis</i>	20	0.01
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	30	0.1
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	80	1

*	Taxon	Height cm	Foliage %
	<i>Ehretia saligna</i> var. <i>saligna</i>	250	0.2
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	20	0.02
	<i>Ficus aculeata</i> var. <i>indecora</i>	200	1.5
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	7	0.02
	<i>Gyrocarpus americanus</i>	100	0.2
	<i>Hakea macrocarpa</i>	450	1
	<i>Heliotropium leptaleum</i>	20	0.15
	<i>Hybanthus aurantiacus</i>	40	0.02
	<i>Melhania oblongifolia</i>	40	0.1
	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i>	40	0.03
	<i>Panicum effusum</i>	30	1
	<i>Polycarpaea longiflora</i>	30	0.01
	<i>Premna acuminata</i>	300	1
	<i>Psydrax pendulina</i>	300	3
	<i>Pterocaulon paradoxum</i>	40	0.1
	<i>Ptilotus polystachyus</i>	40	0.1
	<i>Sorghum plumosum</i>		
	<i>Spermacoce dolichosperma</i>	20	2
	<i>Polymeria ambigua</i>		0.01
	<i>Murdannia graminea</i>	40	0.02
	<i>Grewia retusifolia</i>	100	2
	<i>Gardenia pyriformis</i> subsp. <i>keartlandii</i>		
	<i>Tephrosia remotiflora</i>	50	0.01
	<i>Tinospora smilacina</i>		0.1
	<i>Trianthema pilosum</i>		0.1
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	30	0.05
P3	<i>Triodia caelestialis</i> (P3)	130	35
	<i>Waltheria indica</i>	60	0.4
	<i>Yakirra australiensis</i>	30	0.1
	<i>Zornia prostrata</i> var. <i>prostrata</i>	15	0.01

Note: * depicts an introduced (weed) species

Quadrat 16	Location: GDA 51K 443448 8026575	Date: 5/12/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Tall acacia shrubland emergent euc over triodia and patches of sorghum		
Condition: Excellent		



*	Taxon	Height cm	Foliage %	Comments
	<i>Calandrinia quadrivalvis</i>	20	0.02	
	<i>Carissa lanceolata</i>	100	3	
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	30	0.1	
	<i>Corymbia flavescens</i>	1200	3	Emergent, in edge. 2
	<i>Corymbia greeniana</i>	200	0.2	Emergent, mature trees outside plot.
	<i>Crotalaria brevis</i>	20	0.01	
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	50		
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	150	1	
	<i>Ehretia saligna</i> var. <i>saligna</i>	200	0.2	

*	Taxon	Height cm	Foliage %	Comments
	<i>Ficus aculeata</i> var. <i>indecora</i>	200	0.6	
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	160	0.2	
	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>		0	
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	2	0.01	
	<i>Gymnanthera oblonga</i>		0.01	
	<i>Hakea macrocarpa</i>	200	0.2	
	<i>Heliotropium leptaleum</i>	25	0.01	
	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i>	30	0.05	
	<i>Panicum effusum</i>	30	0.1	
	<i>Polycarpaea longiflora</i>	40	0.02	
	<i>Portulaca oleracea</i>		0.01	
	<i>Psydrax pendulina</i>	300	3	
	<i>Ptilotus lanatus</i>	40	0.01	
	<i>Ptilotus polystachyus</i>	40	0.1	
*	<i>Setaria verticillata</i> *	30	0.2	
	<i>Sorghum plumosum</i>	200	8	
	<i>Spermacoce dolichosperma</i>	20	1.5	
	<i>Gyrostemon tepperi</i>	50	0.02	
	<i>Gardenia pyriformis</i> subsp. <i>keartlandii</i>	350	0.4	
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>		0	
	<i>Tinospora smilacina</i>		0.01	
	<i>Trianthema pilosum</i>		0.1	
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	40	0.02	
P3	<i>Triodia caelestialis</i> (P3)	130	30	
	<i>Ventilago viminalis</i>	150	0.1	
	<i>Waltheria indica</i>	50	0.03	
	<i>Waltheria indica</i>		0	
	<i>Yakirra australiensis</i>	30	0.1	
	<i>Zornia prostrata</i> var. <i>prostrata</i>	15	0.1	

Note: * depicts an introduced (weed) species

Quadrat 17	Location: GDA 51K 440596 8925512	Date: 5/12/2017
Topography: Flat	Soils: Sand pindan	Colour: Red
Vegetation description: Acacia shrubland over sorghum and triodia		
Condition: Excellent		



*	Taxon	Height cm	Foliage %
	<i>Acacia adoxa</i> var. <i>subglabra</i>	30	2
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	400	20
	<i>Acacia tumida</i> var. <i>tumida</i>	10	0.01
	<i>Bauhinia cunninghamii</i>	300	2
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	400	1
	<i>Calandrinia quadrivalvis</i>	20	0.01
	<i>Carissa lanceolata</i>	150	2
	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	20	2
	<i>Corymbia</i> ? <i>polycarpa</i>	700	1
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	40	0.1

*	Taxon	Height cm	Foliage %
	<i>Denhamia cunninghamii</i>	400	2
	<i>Dodonaea hispidula</i> var. <i>Phylloptera</i> (F. von Mueller s.n. MEL101393)	170	5
	<i>Ehretia saligna</i> var. <i>saligna</i>	300	0.2
	<i>Eragrostis eriopoda</i>	30	0.5
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	20	0.01
	<i>Ficus aculeata</i> var. <i>indecora</i>	200	1
	<i>Glycine tomentella</i>		0.1
	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	3	0.01
	<i>Hakea macrocarpa</i>	200	0.2
	<i>Hybanthus aurantiacus</i>	30	0.01
	<i>Polycarpaea longiflora</i>	30	0.02
	<i>Premna acuminata</i>	300	0.3
	<i>Ptilotus lanatus</i>	40	0.01
	<i>Ptilotus polystachyus</i>	30	0.2
	<i>Sorghum plumosum</i>	200	15
	<i>Spermacoce dolichosperma</i>	20	1
	<i>Murdannia graminea</i>	40	0.01
	<i>Grewia retusifolia</i>	200	0.1
	<i>Gyrostemon tepperi</i>	20	0.01
	<i>Gardenia pyrifolia</i> subsp. <i>keartlandii</i>	350	0.2
	<i>Cleome tetrandra</i> var. <i>tetrandra</i>	30	0.01
	<i>Tephrosia remotiflora</i>	40	0.1
	<i>Terminalia volucris</i>	300	0.5
	<i>Tinospora smilacina</i>		0.01
	<i>Trianthema pilosum</i>		0.1
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>	30	0.02
P3	<i>Triodia caelestialis</i> (P3)	130	25
	<i>Ventilago viminalis</i>	160	1
	<i>Waltheria indica</i>	50	0.1

Note: * depicts an introduced (weed) species