Area Clearing Permit Application Supporting Document

Reserve 53878 (Lot 550 on Deposited Plan 421448)

Prepared for Shire of Broome

6 October 2021

Project Number: TW19113

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Approval for Release		
Name	**Position**	**File Reference**
Andrew Mack	Environment Section Leader	TW19113_01-RRRP_Clearing_Permit-1.0
Signature		

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1 Introduction

The Shire of Broome (the Shire) is currently seeking approval to develop a Regional Resource Recovery Park (RRRP) located on Reserve 53878 (Lot 550 on Deposited Plan 421448) at the intersection of Broome – Cape Leveque Road and McGuigan Road, Broome Western Australia (WA) (the Site). The Site (referred to as 'D2') is situated approximately 10 km northeast of the town of Broome (Figure 1). The total area of the Site is 121 hectares (ha) of which the Development Footprint occupies approximately 69.02 hectares (ha). The Site boundary and Development Footprint are shown in Figure 2.

The RRRP will consist of a Community Recycling Centre (CRC) and Class III landfill. The purpose of the CRC is to provide a modern, safe and easy to use facility to encourage the community to divert waste materials from landfill. Any waste material that cannot be reused or recycled will be disposed to landfill in accordance with any required conditions of approval (including a Licence issued under Part V of the *Environmental Protection Act 1986*). Clearing of native vegetation within the Development Footprint is therefore required to establish the infrastructure associated with the RRRP.

1.1 Background

The Shire recognised that its current landfill is rapidly approaching the end of its operational life and planning for the RRRP therefore commenced in 2014 with an extensive site selection study to determine the most suitable location. Following a range of environmental investigations and assessments, the Site was determined to be the most suitable location for establishing the RRRP. Previous clearing within the Site for these investigations was granted under Clearing Permit CPS 8820/1. This clearing was required for the establishment of access tracks, trial pit and groundwater monitoring well locations.

1.2 Ownership and Access

The Site is vested in the Shire under Management Order 0732596 for the purpose of "Waste Management, Transfer and Landfill Facility, Pindan Extraction and Pound" for a period of 21 years (see Appendix A – Reserve Details Report 53878). Access to the Site will occur via Broome – Cape Leveque Road.

1.3 Development Footprint

The Development Footprint (Figure 2) includes the CRC and areas for future expansion of the facility. The Shire has prioritised the progression of the CRC element of the RRRP development and has submitted the relevant environmental approvals of the construction of the CRC. Approval to construct Stage 2 will be sought at a later date. Therefore, clearing within the Development Footprint will be undertaken progressively for each stage. However, the Shire wish to seek permission to clear all vegetation within the Development Footprint to allow for flexibility within this area in which to establish infrastructure for RRRP. The exact location of the infrastructure will be determined at the detailed design stage and through further community consultation.

The infrastructure to be established for each stage is listed below:

Stage 1:

- Community Recycling Centre:
  - Community Recycling Area;
    - Reuse Shop;
    - Education and Administration Area;
    - Green Waste Drop Off and Mulch Collection;
    - Household Hazardous Waste Facility;
    - Recycling Drop Off Area.
  - Mixed Waste Drop Off Facility;
  - Stockpile and Processing Area (and stockpiling expansion areas);
  - Supporting infrastructure:
    - Surface water Management System;
    - Fencing; and
    - Access roads and service areas.

Stage 2:

- Future expansion Areas:
  - Materials Recycling Facility;
  - Class III landfill;
  - Leachate Ponds;
  - Liquid Waste Facility;
  - Surface Water Management System; and
  - Tyre Monocell.

Clearing within the future expansion areas will only be undertaken once the other relevant approvals i.e. a Works Approval to construct the facilities has been granted. However, the total area of Development Footprint the Shire is seeking the Area Clearing permit for is 60.02 ha and this covers both Stages referred to above.

2 Existing Environment

As mentioned previously, the Site is 121ha in size and consists of native vegetation with some disturbance consisting of tracks and areas cleared for groundwater wells granted under Clearing Permit CPS 8820/1.

To understand the ecological values on the Site, the following flora and fauna surveys were completed by Spectrum Ecology:

- Broome Regional Resource Recovery Park - Reconnaissance Flora & Level 1 Fauna Survey (Spectrum Ecology, 2020).
- Broome Regional Resource Recovery Park - Terrestrial Fauna Assessment (Spectrum Ecology, 2020).
- Broome Regional Resource Recovery Park - Detailed Flora and Vegetation Assessment (Spectrum Ecology, 2020).

A summary of the key findings of the surveys is provided in Table 2-1 and a copy of each report is provided in Appendix B . It should be noted that the Site is referred to as Site D2 within all reports.

The data gathered during these surveys has been submitted to the Index of Biodiversity Survey for Assessments (IBSA).

Table 2-1: Summary of environmental aspects

Aspect	Findings
Climate	Dry, hot and tropical, divided into a dry and wet season. Dry season - April to November, little rain and daily temperatures around 30°C. Wet season - December to March, average temperatures are a few degrees higher along with erratic, often heavy rainfall, high humidity and the possibility of tropical cyclones. Annual average rainfall - 628.1mm however highly variable, from as low as 132mm up to 1599mm.
Bioregion	Pindanland (DAL02) IBRA subregion within the larger Dampierland (DAL) region
Land systems	Yeeda: Sandplains and occasional dunes with shrubby spinifex grasslands or pindan woodlands. Wanganut: Sandplains and dunes with pindan woodlands and spinifex/tussock grasslands
Pre-European Vegetation Mapping	*Acacia tumida* shrubland with grey box and cabbage gum medium woodland over ribbon grass & curly spinifex
Geology	Sm10 SILTY SAND - red, fine-grained, sub-rounded quartz, variable silt content, homogeneous 122 100% Qz Red sand, fine to medium; minor silt; aeolian 122 100%
Vegetation type(s)	*Corymbia greeniana low open woodland* with *Acacia eriopoda* and *Bauhinia cunninghamii* tall open shrubland, over *Triodia schinzii* and *Triodia caelestialis* low

	sparse hummock grassland and *Chrysopogon pallidus* and *Sorghum plumosum* low sparse tussock grassland.
Vegetation condition	Excellent
Years since last fire	2-5 years
Threatened and Priority Flora	No threatened flora were recorded within the site or considered likely to occur. Three significant flora *Corymbia paractia* (Priority 1), *Terminalia kumpaja* (Priority 3) and *Jacquemontia sp*. Broome (A.A. Mitchell 3028) were recorded in the Site. The three Priority taxa recorded were assigned a low local and regional significance. The location of the priority flora species recorded within the Site is shown in Figure 2.
Threatened and Priority Ecological Communities	No Threatened Ecological Communities (TECs) are lcoated within the Site. The buffers of two P1 Priority Ecological Communities (PEC) are located in the north west corner of the Site. Mangarr (Minyjuru) is described as "relict dune system dominated by extensive stands of Minyjuru (Mangarr – Sersalisia sericea)" and Corymbia paractia is "Corymbia paractia dominated community on dunes." The location of the PEC and the development footprint is shown in Figure 2.
Environmental Sensitive Areas or Conservation Estates	None located within the site. Yawuru Birragun Conservation Reserve is located directly adjacent to the site.
Conservation Significant Fauna	No conservation significant fauna species or evidence of these species was recorded within the site. The likelihood of the conservation significant fauna is shown in Table 4.1 of the Broome Regional Resource Recovery Park - Terrestrial Fauna Assessment (Spectrum Ecology, 2020).
Fauna Habitat	Pindan Shrubland habitat
Short Range Endemics	No Western Australian Museum records occur within the site. One undescribed species Lychas 'BSCO048' a scorpion belonging to potential SRE taxa was collected from dry pitfall traps during survey. Low likelihood that the habitat within the Site supports any taxa with a distribution restricted to the Site.
Introduced species	Four introduced species *(?Lolium perenne*, *Conyza bonariensis*, *Stylosanthes hamata* and *Stylosanthes scabra*) were recorded within the Site however none of these species are declared pests in WA.
Years since last fire	2-5 years

3 Clearing Works

As mentioned previously, the total Clearing Area or Development Footprint the Shire is seeking the Area Clearing permit for is 69.02 ha (57% of the Site). Approximately 11.67ha (~16% of the Development Footprint which equates to 9.6% of the whole Site) will be initially cleared for establishment of the CRC. The Development Footprint is shown in Figure 2 and provided as a ESRI shapefile.

The Shire will aim to minimise disturbance through the following management methods:

- Prior to disturbance activities, the clearing and disturbance area will be demarcated. The clearance and disturbance area will be defined using high visibility tape and or spray paint where suitable to ensure operators undertake activities within the clearing boundary;
- Avoid, minimise and reduce the impact of clearing as far as practicable;
- Clearing to be undertaken in a progressive manner to allow fauna to move into adjacent native vegetation ahead of clearing;
- Undertake measures to minimise the spread of any introduced species within the Site; and
- A clearing supervisor or spotter will be present at all times to ensure all clearing and disturbance is undertaken within the proposed clearing boundaries.

4 Native Vegetation Clearing Principles

To assess the potential impacts of clearing for the CRC, the Site was assessed against the ten native vegetation clearing principles. The variance to each principle is shown in Table 4-1 which is further explained within the Memo by Spectrum Ecology (Appendix C).

Table 4-1: Assessment against 10 Clearing Principles

Principle		Variance
a)	Native vegetation should not be cleared if it comprises a high level of biological diversity	Not at variance
b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	Not at variance
c)	Native vegetation should not be cleared if it includes, or is necessary for, the continued existence of rare flora	Not at variance
d)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a threatened ecological community	Not at variance
e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	Not at variance
f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	Not at variance
g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	Not at variance
h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	Not at variance
i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Unlikely to be at variance
j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	Not at variance

5 Environmental and Heritage Risk Management

The key potential risks from the clearing of native vegetation on the Site include:

- Disturbance to PECs;
- Removal of Priority Flora;
- Generation of dust;
- Introduction and/or spread of weeds;
- Disturbance to unknown Aboriginal Heritage sites or artefacts; and
- Safety risks.

Each of these aspects and the proposed management is discussed in the following sections.

5.1 Priority Ecological Community

Priority Ecological Community (PEC) Mangarr (Minyjuru) and buffer are located in the northwest portion of the Site. A small portion of the Development Footprint (levee bund and future landfill cells) is located within the Mangarr (Minyjuru) PEC buffer (~3.27ha). Two records of Corymbia paractia PEC are located within the Development Footprint. Although the Mangarr (Minyjuru) PEC (buffer) and C. paractia PECs are impacted the occurrence of these PECs is not considered a significant occurrence within the landscape context. Spectrum Ecology concluded that the disturbance of the PEC was not at variance with the Native Vegetation Clearing Principles.

5.2 Priority Flora

The Development Footprint contains three priority flora species; 8 Corymbia paractia (P1) individuals, 31 Jacquemontia sp. Broome (P1) individuals, and 18 Terminalia kumpaja (P3) individuals. However, the populations are not considered significant, due to the low number of individuals recorded within site and surrounds. Spectrum concluded that clearing within the Site is unlikely to threaten the continued existence of the recorded Priority Flora and other Priority Flora with High Likelihood of occurrence and that this vegetation is not necessary for the continued existence of conservation significant flora.

5.3 Dust

Dust will be generated during clearing activities which can cause reduced visibility and nuisance. Dust will be supressed using a water cart as required.

5.4 Topsoil and Vegetation

Cleared vegetation will be stockpiled within the Green Waste Stockpiling and Processing Area. Topsoil and soils will be stockpiled separately for reuse.

5.5 Weed Control

To avoid the introduction and/or spread of weeds the following management measures will be adopted:

- Earth-moving machinery shall be clean of soil and vegetation prior to entering and leaving the area to be cleared;
- Soils shall only be moved in dry conditions;
- Ensure that no weed-affected soil, mulch, fill or other material is brought into the area to be cleared; and
- Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

5.6 Heritage

A Heritage Survey was conducted across the Site in late February and early March 2020 by Nyamba Buru Yawuru Pty Ltd (Yawuru) and Kimberley Land Council (KLC). The report concluded that the survey team "did not identify anything of cultural heritage value" (Justin Lincoln, 2020). However, the Yawuru will be notified and given the opportunity to be present during clearing activities to ensure no impacts to any unknown Aboriginal Heritage values occur.

5.7 Safety

To ensure the safety of personnel and the environment the following controls are proposed:

- Pre-operation weather check to ensure conditions are suitable for activities;
- All personnel to undertake a Job Hazard Assessment (JHA) at the morning daily pre-start meetings prior to commencement of activities;
- All personnel involved in the investigations will conform to fitness to work criteria;
- All plant/equipment to be subject to a daily Pre-start Check;
- Site supervisor to inspect area to identify and assess for any further hazards;
- A Take 5 will be conducted for new/other hazards if required; and
- Clear communication between operators, supervisor, ecological and heritage representatives to be maintained at all times;
- Operation of machinery will occur according to the contractors' method statements and safe-work procedures; and
- Correct Personnel Protective Equipment (PPE) will be worn by all personnel at all times.

5.8 Clearing Records

The following information will be recorded during and post clearing activities:

- Date of clearing;
- Size of area cleared;
- Location using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings;
- Actions taken to avoid, minimise and reduce the impacts and extent of clearing activities; and
- Actions taken to minimise the risk of the introduction and spread of weeds.

Summary

The information in this document has been provided to support the Shire's application for an Area Clearing Permit for the Site. The Shire seeks permission to clear vegetation within the 69.02ha Development Footprint for the purposes of establishing the RRRP.

All proposed clearing will be undertaken as outlined in this document to ensure all environmental impacts are minimised and managed. Stage 1 clearing works will be undertaken following the grant of a Works Approval by the Department of Water and Environmental Regulation.

Figures

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LEGEND

- Site Boundary
- Primary Road
- Secondary Road

LOCALITY
LOT No.550
Cape Leveque Road

Clearing Permit Application
Shire of Broome

N
Metres
0 500 1,000 1,500 2,000
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:50,000

Prepared:	N Johnston	Date:	29/07/2021
Reviewed:	E Porter	Revision:	A
Project:	TW19113		

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Figure 01

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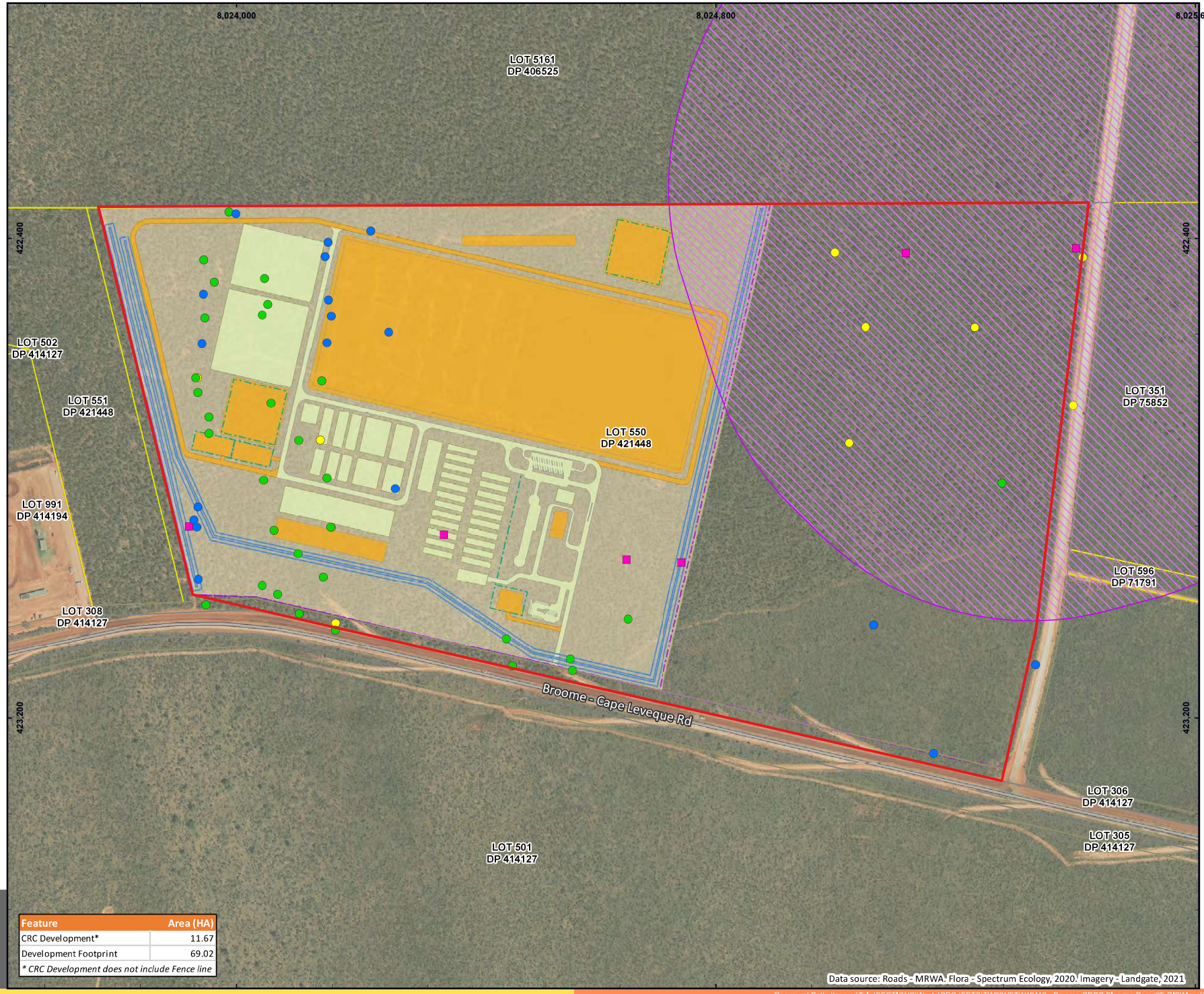

Feature	Area (HA)
CRC Development*	11.67
Development Footprint	69.02

** CRC Development does not include Fence line*

Data source: Roads - MRWA; Flora - Spectrum Ecology, 2020. Imagery - Landgate, 2021

LEGEND

- Boundary Fence
- Security Fence (Future)
- Secondary Road
- Site Boundary
- Priority Ecological Communities (PEC)
- Levee
- CRC Development
- Future Development
- Development Footprint

Significant Flora

- Sersalisia sericea (PEC Indicator Species)
- Corymbia paractia (P1)
- Jacquemontia sp. Broome (A.A. Mitchell 3028) (P1)
- Terminalia kumpaja (P3)

0 4 8 12 16 20 km

SITE DEVELOPMENT AND SIGNIFICANT FLORA

LOT No.550
Cape Leveque Road

Clearing Permit Application
Shire of Broome

N 0 50 100 150 200 M

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:6,000

Prepared:	N Johnston	Date:	29/07/2021
Reviewed:	E Porter	Revision:	C
Project:	TW19113		

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Figure 02

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APPENDIX B
Vegetation, Flora and Fauna Surveys

BROOME REGIONAL RESOURCE RECOVERY FACILITY

RECONNAISSANCE FLORA & LEVEL 1 FAUNA SURVEY

PREPARED FOR: SHIRE OF BROOME

Spectrum ECOLOGY

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Report Details			
Project Description:	Broome Regional Resource Recovery Park Reconnaissance Flora & Level 1 Fauna Survey		
Prepared For:	Shire of Broome		
Project ID:	1932		
Version History	Author	Reviewer	Date of Issue
Version 1	Carmel Forrester Astrid Heidrich Damien Cancilla	Damien Cancilla	15-Jan-2020
Version 2	Chris Parker Damien Cancilla	Damien Cancilla	29 Jan 2020

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EXECUTIVE SUMMARY

The Shire of Broome is investigating two sites ('D2' and 'G1') for the placement of the Broome Regional Resource Recovery Park. As part of the site investigations, a range of hydrogeological and geotechnical works are required which will require some impact to and removal of native vegetation. Approximately 25ha will be disturbed within D2 and 30ha within G1 to establish trial pits, bores and temporary tracks.

The Shire of Broome commissioned Spectrum Ecology to undertake a Reconnaissance Flora and Level 1 Fauna Assessment at each of the proposed sites to support an application for a Native Vegetation Clearing Permit for the preliminary site investigations required for the Project, including comments on the Clearing Principles. A subsequent phase two field survey is scheduled to follow this Reconnaissance survey if development of the site continues.

The Study Areas are located in the Pindanland IBRA subregion within the larger Dampierland region. D2 Study Area is 122 ha and located 9 km north of Broome township on the southwest side of the McGuigan and Broome – Cape Leveque Road intersection. The G1 Study Area is located along the north side of the Broome Road (Great Northern Highway), 32 km northeast of Broome township. Both sites are in Pindan plains, set back from the coast, dunes and mangroves.

The climate near Broome is dry, hot and tropical, divided into a dry and wet season. The dry season runs from April to November, with very little rain and the wet season is from December to March, during which time the region receives most of the year's rainfall. The field survey was conducted on the 26 November by one botanist. Conditions were dry. In the 12 months preceding the survey, the region received half as much rainfall as the expected median.

Flora

Eight previous surveys within 20 km of the study areas and the database searches returned six Priority Flora taxa either Recorded from, or with High Likelihood of occurrence in the study areas. They were:

- *Corymbia paractia* (P1), Previously Recorded;
- *Jacquemontia* sp. Broome (P1), High Likelihood of occurrence;
- *Glycine pindanica* (P3), High Likelihood of occurrence;
- *Polymeria* sp. Broome (P3), High Likelihood of occurrence;
- *Seringia katatona* (P3), High Likelihood of occurrence;
- *Terminalia kumpaja* (P3), High Likelihood of occurrence;

A total of 45 taxa from 18 families and 34 genera were recorded during the survey. No flora of conservation significance were recorded during the current field survey. Additional surveys with better seasonal conditions are required to conclusively determine presence/absence of flora with High Likelihood of occurrence. Particularly *Corymbia paractia* (P1), *Jacquemontia* sp. Broome (P1) and *Polymeria* sp. Broome (P3). A survey conducted after sufficient rainfall in the period of March to May when the herbaceous species are flowering would enable confirmation of the presence of absence of these species. Impact to *C. paractia* can be minimised by avoiding the clearing of Eucalupt/Corymbia species during sight investigation activities.

Vegetation

The study areas are not located within any Conservation Estates or Environmentally Sensitive Areas, however the Yawuru Birragun Conservation Reserve is located directly adjacent to the D2 Study Area. Both study areas are located to the north of a large Environmentally Sensitive Area (ESA) that comprises the Roebuck Bay and associated Roebuck Plain areas. Conservation Estate and ESAs within the vicinity

Twelve ecosystems of conservation significance consisting of 118 records were identified from the database search. These include:

- Monsoon (vine) thickets on coastal sand dunes of the Dampier Peninsula, federally listed as Threatened and state listed as Vulnerable;
- Roebuck bay mudflats, state listed as Vulnerable;
- 87 records of Priority 1 communities;
- 17 records of Priority 3; and
- One record of a Priority 4 community.

The north-western corner of the D2 Study Area intersects the Priority 1 Priority Ecological Community Mangarr (Minyjuru) (Unique Code 17327). This community represents the relict dune system dominated by extensive stands of Miniyjuru (Mangarr) *Sersalisia* (formerly *Pouteria*) *sericea*. The habitat observed within the D2 Study Area is not typical of the habitat associated with the characteristic species, *Sersalisia sericea*. Additional survey effort in the area of D2 within the PEC buffer zone will confirm the presence or absence of this PEC; however, the 30 ha infrastructure footprint does not currently impact this area.

Three vegetation types were recorded from the study areas (two in G1 and one in D2). Each of them are common and reflect the 750.1 Vegetation Association Unit from the Pre-European Beard mapping. Vegetation Type 1 is the known habitat for Priority 1 species, *Corymbia paractia*, this vegetation type is considered significant as it plays a role in refuge for conservation significant flora.

No conservation significant vegetation was recorded from the G1 Study Area.

Fauna

Both study areas are dominated by Pindan Shrubland habitats which consist of open to sparse *Acacia* sp. shrubland over tussock grassland. The literature review and database search identified 53 mammal, 165 bird, 81 reptile and 15 amphibian species that could occur in the region surrounding the study areas. Results of the literature review identified 31 conservation significant fauna species (12 mammal, 15 bird and 5 reptile species). Both study areas do not include any marine or wetland habitats and all species that utilise these habitat types have been excluded from the assessment including an additional 61 conservation significant bird species and two mammal species that are associated with marine, shoreline and wetland environments.

The Greater Bilby (*Macrotis lagotis*) is considered to have a high likelihood of occurrence within both the D2 and G1 Study Areas. The Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*), Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*), Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*) and Northern Coastal Free-tailed Bat (*Mormopterus (Ozimops) cobourgianus*) are considered to have a medium likelihood of occurrence in the Study Areas. Of the 15 conservation significant bird species identified, six species (Gouldian Finch (*Erythrura gouldiae*), Oriental Cuckoo (*Cuculus optatus*), Barn Swallow (*Hirundo rustica*), Fork-tailed Swift (*Apus pacificus*), Grey Falcon (*Falco hypoleucos*) and Peregrine Falcon (*Falco peregrinus*)) are considered to have a medium likelihood of

occurrence. The Dampierland Goanna (*Varanus sparnus*) is considered to have a medium likelihood of occurrence.

The WA Museum (WAM) Short Range Endemic (SRE) invertebrate database search identified 16 taxa of Arachnida, one Crustracea taxa and two Mollusca taxa. Of the SRE taxa identified from the WAM database searches, only four taxa have a high likelihood of occurrence and eight are considered to have a medium likelihood of occurrence.

Clearing of either Study Area is not expected to significantly impact any terrestrial vertebrate fauna species identified during this study. Preclearing searches for evidence of active Greater Bilby burrows should be completed immediately prior to any clearing activities. With the exception of the Northern Brushtail Possum, any individuals present within the clearance area are expected to flee the area immediately prior to clearing due to the high noise and vibrations associated with clearing activities. Clearing activity conducted in either Study Area is not expected to have a significant impact on any SRE invertebrate taxa due to the widely distributed habitats present with the study area.

1. INTRODUCTION

1.1. Project Background

The Shire of Broome is investigating two sites ('D2' and 'G1') for the placement of the Broome Regional Resource Recovery Park (RRRP) (the Project) (Map 1.1). As part of the site investigations, a range of hydrogeological and geotechnical works are required which will require some impact to and removal of native vegetation (approximately 25 ha for D2 and 30 ha for G1). The disturbance to the vegetation will include access tracks, boreholes and trial pits.

The Shire of Broome commissioned Spectrum Ecology to undertake a Reconnaissance Flora and Level 1 Fauna Survey at each of the proposed sites to support an application for a Native Vegetation Clearing Permit (NVCP) for the preliminary site investigations required for the Project.

1.2. Scope of Work

The scope of work was to complete a Reconnaissance Flora and Vegetation and Level 1 Fauna Assessment. The following is a brief technical report and survey data that satisfies the relevant regulatory guidance statements and documents the results, findings and limitations of the survey.

1.3. Legislation and Guidance

Flora and fauna in Western Australia are protected by various legislation, including:

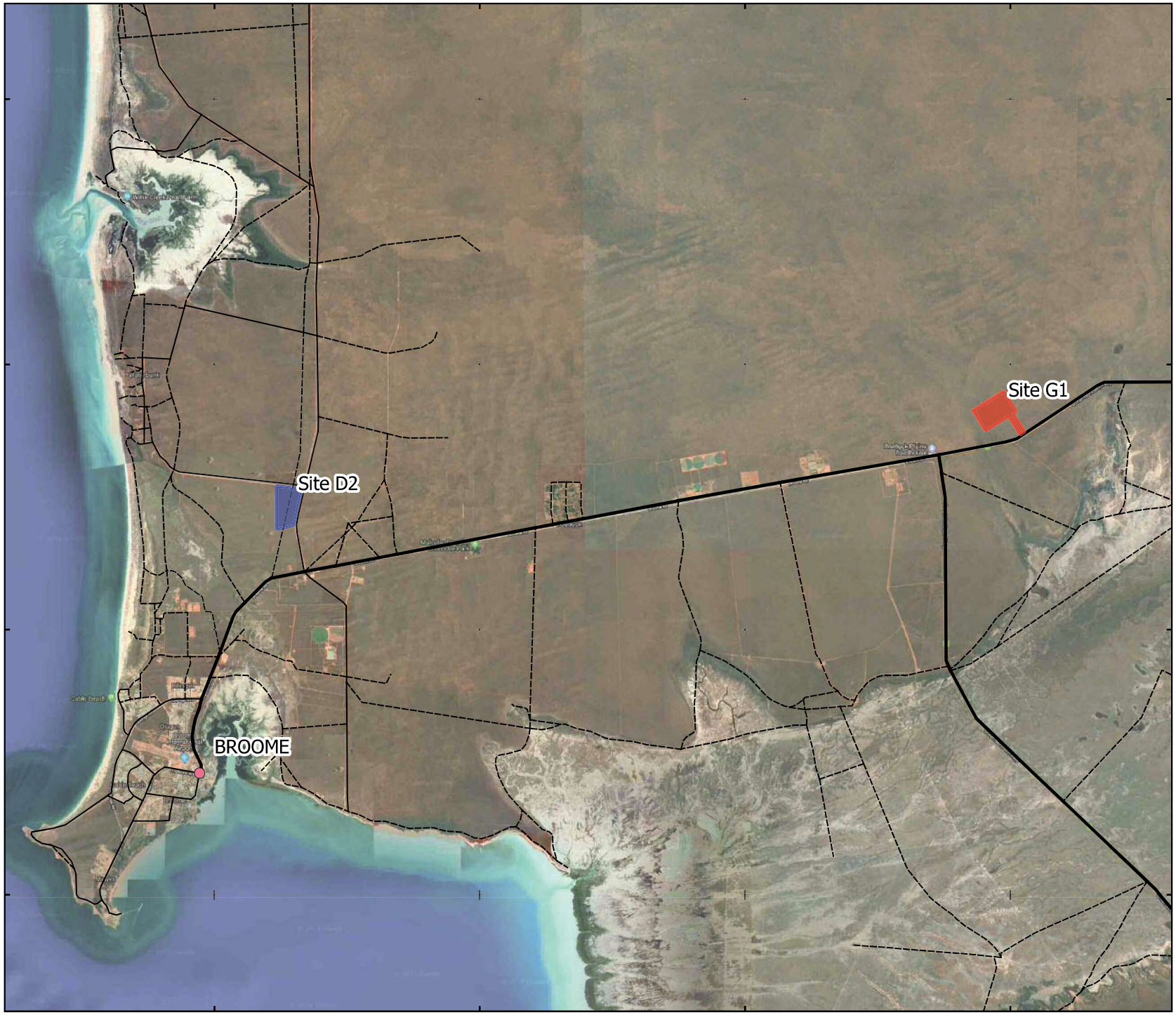
- Biodiversity Conservation Act 2016 (BC Act), which replaced the Wildlife Conservation Act 1950 (WC Act) as of 1 January 2019 (Western Australian Government, 2016);
- Environmental Protection Act 1986 (EP Act); and
- Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The surveys are compliant with Reconnaissance flora and vegetation survey guidelines and Level 1 fauna survey guidelines, as outlined in:

- EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b);
- EPA Technical Guidance: Terrestrial Fauna Surveys (EPA 2016c); and
- EPA Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016d).

This assessment is also consistent with the following guidelines:

- EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002);
- EPA Environmental Factor Guideline: Flora and Vegetation (EPA 2016a);
- National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual (ESCAVI, 2003);
- EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004); and
- EPA & DEC Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC, 2010).

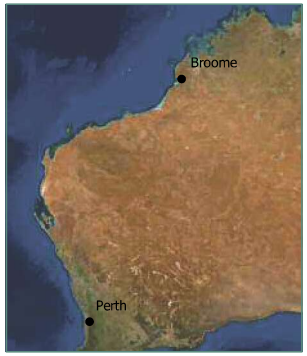


Legend

- Site D2
- Site G1

Roads

- Principal Road
- Minor Road
- Track



0 1 2 3 4 5 km

Scale 1:200000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: AH Date: 14-01-2020

Location of the Study Areas

Proposed Waste Facility

Map 1.1

Prepared for
Shire of Broome | Talis

1.4. Bioregion and Climate

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into regions based on dominant landscape, climate, lithology, geology, landform and vegetation (Thackway and Cresswell, 1995).

The study area is located in the Pindanland (DAL02) IBRA subregion within the larger Dampierland (DAL) region. The Pindanland subregion comprises the western half of Dampierland, including the sandplains of the Dampier Peninsula, extending south along the hinterland of Eighty Mile Beach and north to include the paleodelta of the Fitzroy River (Graham, 2002). It is further described as having a fine-textured sand-sheet with low dunes covered by pindan vegetation, being the coastal, semi-arid, north-western margin of the Canning Basin (Graham, 2002). Inland vegetation typically consists of *Triodia* spp. (spinifex) or *Chrysopogon* spp. (ribbon grass) grasslands under *Acacia* spp. open shrub with low open woodlands of *Eucalyptus* spp.

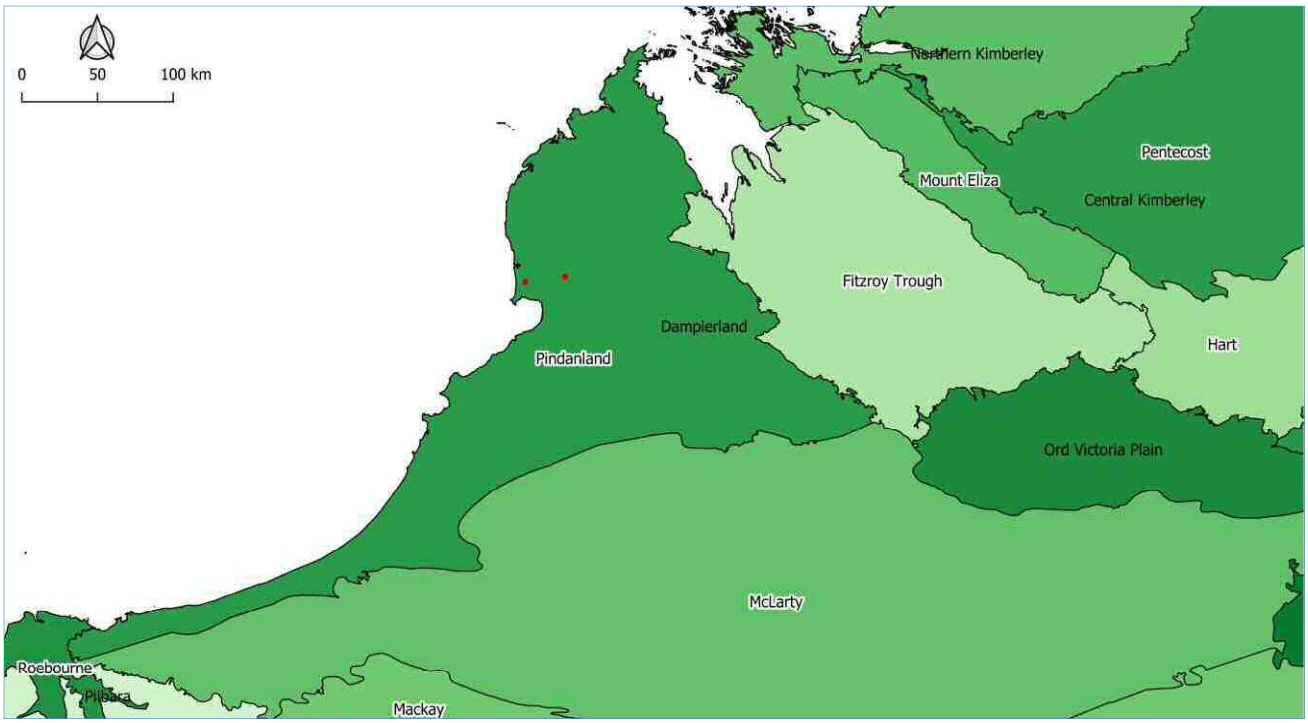


Figure 1.1: IBRA Classification of the Study Areas

The climate near Broome is dry, hot and tropical, divided into a dry and wet season. The dry season runs from April to November, with very little rain and daily temperatures around 30°C. During the wet season, from December to March, average temperatures are a few degrees higher along with erratic, often heavy rainfall, high humidity and the possibility of tropical cyclones. The annual average rainfall is 628.1mm, however the range of recorded annual rainfall is highly variable, from as low as 132mm up to 1599mm (Bureau of Meteorology, 2019).

Climate data recorded by the Broome Airport BOM Station (#003003) is presented in Figure 1.2. Seasonal conditions in the wet season prior to the survey were more dry than usual. Rainfall recorded twelve months prior to mobilisation (Dec 2018 – Nov 2019) was 295.8 mm, which represents less than half of the annual median rainfall recorded by the station (624 mm). In particular, the six months preceding the survey (May 2019 – Nov 2019) received 13 % of the monthly median, a total of 4.8 mm from a median of 65.3 mm for that period (1940-2019).

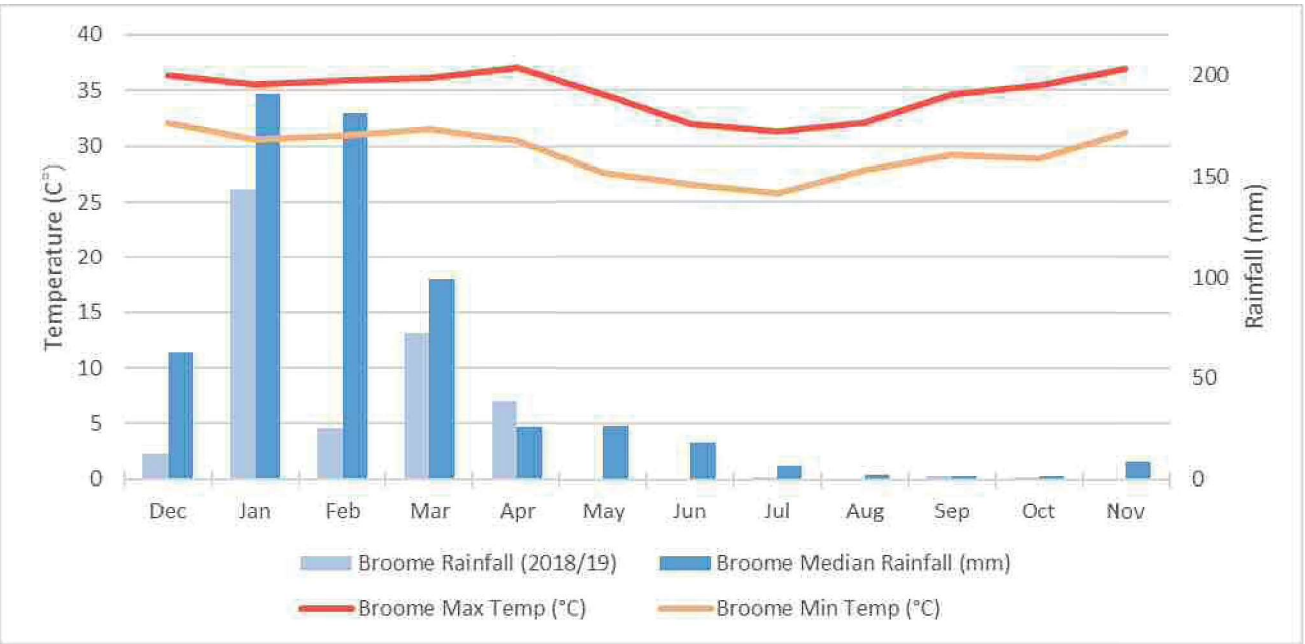


Figure 1.2: Climate Data from Broome Airport (BOM Station #003003) from 1940 to 2019

1.5. Disturbance History

The dominant land uses for the Pindanland subregion include grazing on native pastures, unallocated crown land, and crown reserves (Graham, 2002). Both study areas are located within 6 km of the Broome town site and are bordered either by Broome Road or Broome-Cape Leveque Road respectively. Both roads are frequently used, particularly Broome Road, which is bituminised and is the main access road into and out of Broome. At the time of survey, the most recent fire within the study area appears to have occurred over five years ago.

1.6. Vegetation

Pre-European vegetation mapping was originally undertaken by Beard at various scales across the state and has since been updated to be consistent with the National Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (DPIRD 2019).

One unit (750.1) has been mapped for both the study areas. The units are listed in Table 1.2 and shown in Figure 1.3. State-wide vegetation statistics are available for these units which list pre-European extent, current extent, area in DBCA managed lands etc., and is a useful tool to determine if a vegetation unit is rare or otherwise significant (Government of Western Australia, 2019).

The Beard vegetation unit recorded at the study areas is the second largest vegetation unit described for Dampierland on of the most prominent Pindanland vegetation units.

Table 1.1: Vegetation Associations Mapped within the Study Areas

Sub-association	NVIS Level V Vegetation Description	Area in Study Area (ha)	% of Study Area	Pre-European Whole State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Land
750.1	*Acacia tumida* shrubland with grey box and cabbage gum medium woodland over ribbon grass & curly spinifex	D2 – 122 G1 – 124	D2 – 100% G1 – 100%	1,221,911.24	1,218,020.52	99.68	2.73

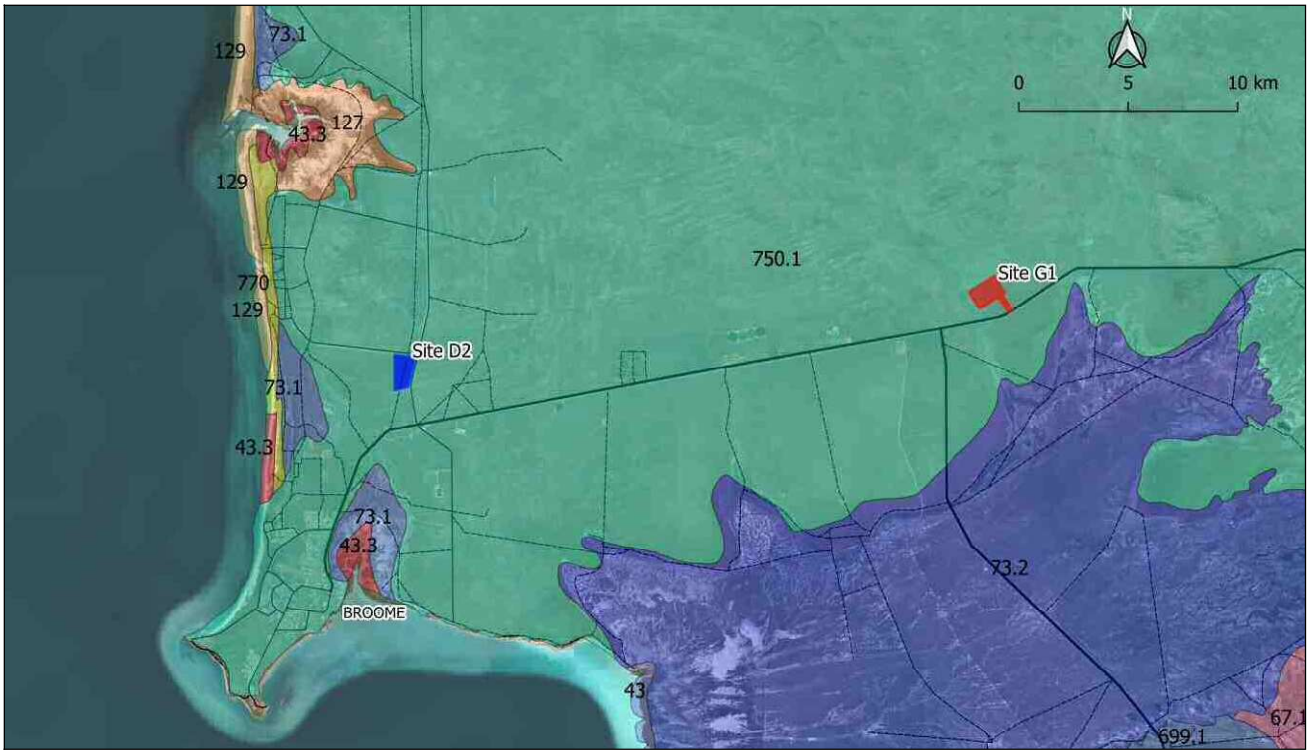


Figure 1.3: Pre-European Vegetation Units at the Study Area

1.7. Geology

The geology of Western Australia has been mapped at a scale of 1:50,000, 1:100,000 and 1:250,000. The township of Broome has been mapped to the finer scale 1:50,000 with the surrounding region limited to a 1:250,000 scale (Figure 1.4). Finer scale geology mapping is only available for the D2 Study Area.

The D2 Study Area occurs within the Sm10 (1:50k) and Qz (1:250k) geological units. Both units are described as homogenous fine grained red sands. The G1 Study Area is located over two geological units (Qs & Qa) both of which comprise of sand, although the Qa system consists of more fine water deposited material associated with the Roebuck plains system. Both geological units occur extensively in the surrounding region. The units are listed in Table 1.2 and shown in Figure 1.2.

Table 1.2: Geological Units of the Study Area (1:250,000)

Code	Description	Area in Study Area (ha)	% of Study Area
D2 Study Area			
Sm10	SILTY SAND - red, fine-grained, sub-rounded quartz, variable silt content, homogeneous	122	100%
Qz	Red sand, fine to medium; minor silt; aeolian	122	100%
G1 Study Area			
Qs	Sand, silt; minor gravel: mixed alluvial and aeolian	81.4	66%
Qa	Sand, silt, clay; minor gravel: alluvial and lacustrine	42.6	34%

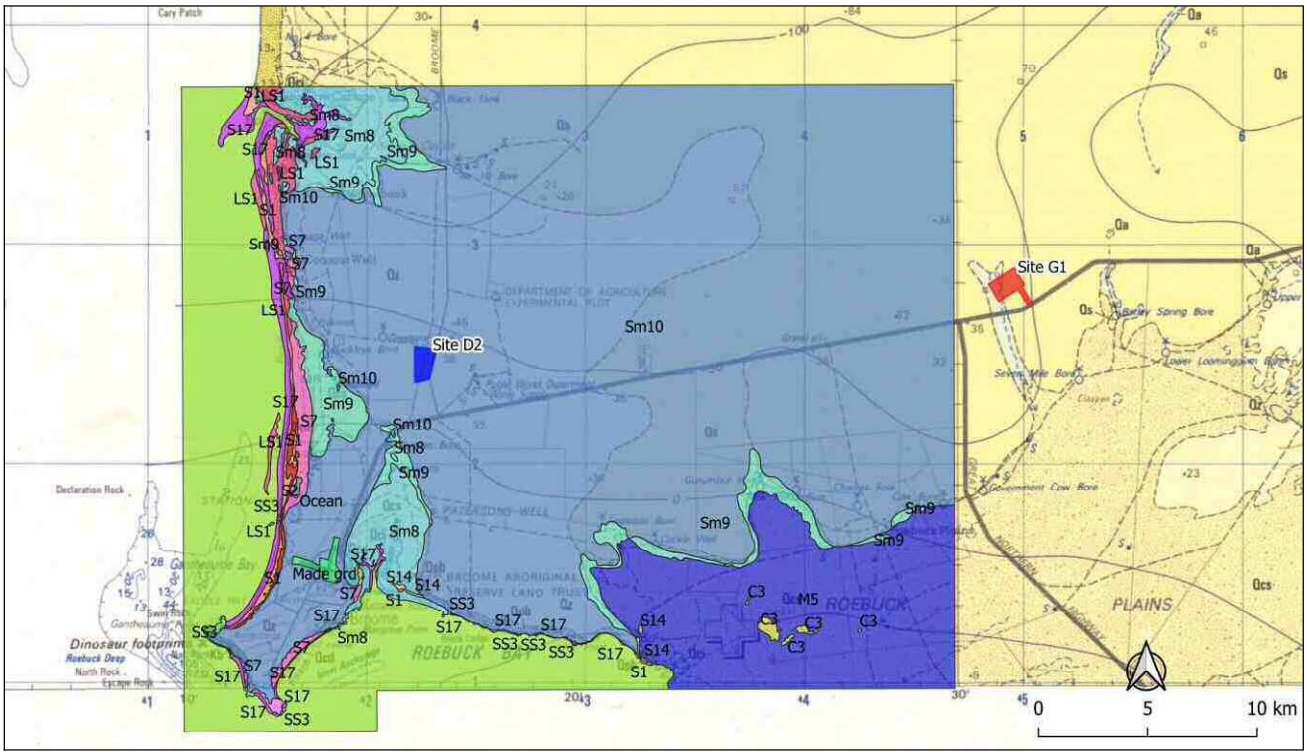


Figure 1.4: Geological Mapping of the Study Areas

1.8. Land Systems

Both study areas lie across the boundary between Yeeda and Wanganut land systems (Schoknecht and Payne, 2011). The Yeeda land system is dominated by red sandplains supporting pindan vegetation with dense Acacia shrubs, scattered bloodwood and grey box trees and curly spinifex and ribbon grass. The Wanganut land system is dominated by low-lying sandplain and dunefields with through-going drainage (Schoknecht and Payne, 2011).

- Yeeda: Sandplains and occasional dunes with shrubby spinifex grasslands or pindan woodlands.
- Wanganut: Sandplains and dunes with pindan woodlands and spinifex/tussock grasslands.

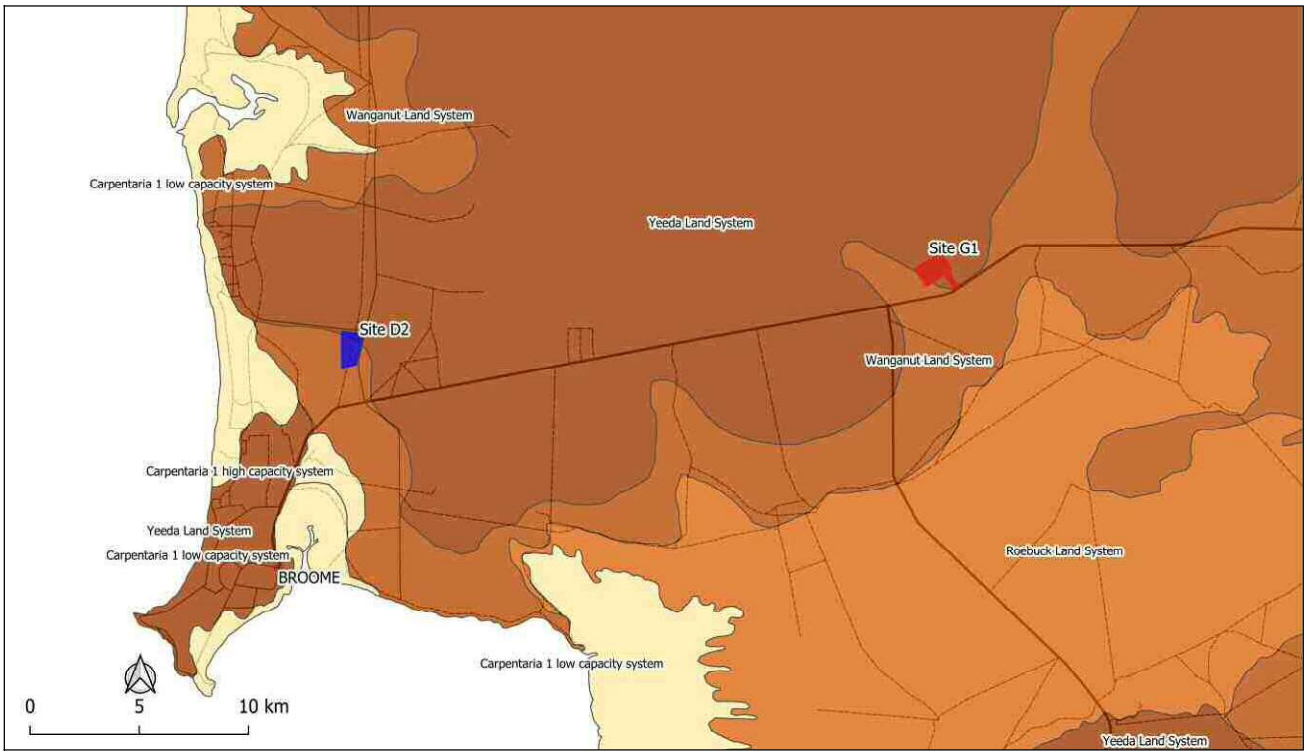


Figure 1.5: Land Systems of the Study Area

1.9. Conservation Estate and Environmentally Sensitive Areas

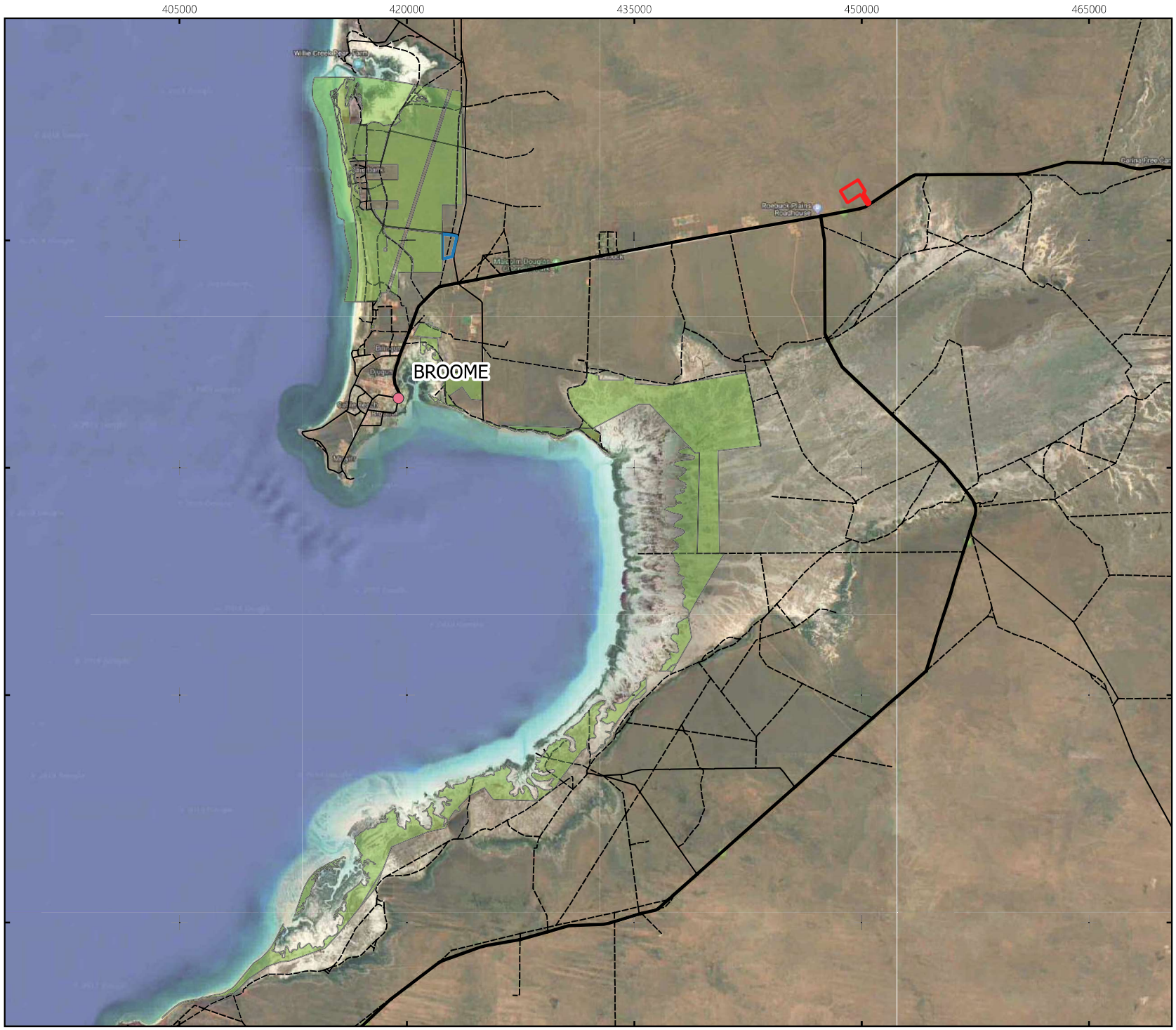
Searching the Collaborative Australian Protected Area Database (CAPAD), several small state protected areas were found located within 50km of the study area. These protected areas and their approximate distance from the study area are listed in Table 1.3.

Table 1.3: Protected Areas in the Vicinity (50 km) of the Study Area

Reserve Name (Protected Area ID)	Relevant to the Study Area		Comment (Jurisdiction/Size)
	Distance	Direction	
5(1)(h) Reserves			
Broome Bird Observatory (WA_41066)	D2 – 13.8 km G1 –23.9 km	Southeast Southwest	Western Australia, 2.7 ha
Broome Wildlife Centre (WA_47964)	D2 – 6.5 km G1 – 32.3 km	Southwest West southwest	Western Australia, 5.0 ha
Unnamed (WA_51105)	D2 – 11.9 km G1 –26.6 km	South Southwest	Western Australia, 317.0 ha
Yawuru Conservation Estate (WA_51162)	D2 – 5.5 km G1 – 30.5 km	West West	Western Australia, 2515.6 ha
Unnamed (WA_51497)	D2 – 4.6 km G1 – 28 km	South Southwest	Western Australia, 716.5 ha
Unnamed (WA_51583)	D2 – 11.9 km G1 – 13.3 km	Southeast Southwest	Western Australia, 4896.0 ha
Unnamed (WA_51617)	D2 – 13.6 km G1 – 24.9 km	Southeast Southwest	Western Australia, 5.7 ha

Reserve Name (Protected Area ID)	Relevant to the Study Area		Comment (Jurisdiction/Size)
	Distance	Direction	
Unnamed (WA_51932)	D2 – 19.4 km G1 – 20.8 km	Southeast Southwest	Western Australia, 5778.5 ha
Yawuru Birragun Conservation Park (WA_52354)	D2 – Directly adjacent G1 – 25km	West West	Western Australia, 7223.8 ha

The study areas are not located within any Conservation Estates or Environmentally Sensitive Areas, however the Yawuru Birragun Conservation Reserve is located directly adjacent to the D2 Study Area. Both study areas are located to the north of a large ESA that comprises the Roebuck Bay and associated Roebuck Plain areas. Conservation Estate and ESAs within the vicinity are mapped in Map 1.3.

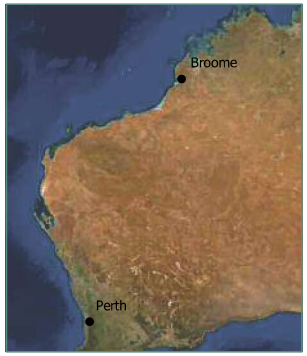


Legend

- Site D2
- Site G1
- Conservation Estates

Roads

- Principal Road
- Minor Road
- Track



0 2 4 6 8 km

Scale 1:350000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: DC Date: 14-01-2020

Conservation Estate Locations

Proposed Waste Facility

Map 1.2

Prepared for
Shire of Broome | Talis

1.9.1. Literature Review & Database Searches

A desktop review of all relevant and available flora, vegetation and terrestrial fauna data sources was undertaken prior to the field survey to determine the species and communities that are likely to occur in the study area. This review included searches of relevant databases and a review of relevant literature from the surrounding region.

1.9.2. Database Searches

The database searches completed for this project are listed in Table 1.4:

Table 1.4: Details of database searches

Data Source	Custodian	Details
Threatened Flora Database	Department of Biodiversity, Conservation and Attractions (DBCA)	Buffer: 50 km around a central point
Threatened Fauna Database		Buffer: 10 km around D2; 15 km around G1
Threatened Ecological Communities Data Base		Buffer 50 km around a central point
Invertebrate Fauna Databases	Western Australian Museum	Arachnids & Myriapods, Crustacea and Mollusca. Results provided from Dampier Peninsula
Commonwealth Protected Matters Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 13/11/19 Buffer: 40 km
NatureMap	Department of Parks and Wildlife / Western Australian Museum	Date: 13/11/19 Centre point: 17°54'10"S, 122°20'17"E Buffer: 40 km

1.9.3. Literature Review

A desktop review of all relevant and available literature was undertaken prior to the field assessment. The following previous survey reports were searched to determine species and conservation significance likely to occur in the study area. The Index of Biodiversity Surveys and Assessments (IBSA) was also utilised to access available previous assessment reports from the surrounding region. Details of each report are summarised in Table 1.5 and survey areas are mapped in Map 1.3.

Table 1.5: Details of the Literature Review Reports

Report Title	Level of Assessment	Field Survey Timing
Mamabulanjin Orchard Flora and Fauna Survey (GHD, 2019).	Detailed and targeted flora & vegetation. Level 1 and targeted fauna.	1-2 May 2019 (flora & vegetation). 5-6 May 2019 (fauna).
Distribution, ecology and cultural importance of Gunurru or Cable Beach Ghost Gum *Corymbia paractia* in the Broome area, Western Australia (Environs Kimberley, 2018).	Targeted survey and distribution mapping of Cable Beach Ghost Gum *Corymbia paractia*.	November – December 2016 (flowering period).
Broome Road Industrial Area Targeted Survey (GHD, 2018).	Targeted flora survey (*Polymeria* sp. Broome and *Jacquemontia* sp. Broome).	24-27 April 2017, 10-12 May 2017.
Flora, Vegetation and Fauna Assessment – Broome Asparagus Farm (AECOM, 2017).	Detailed (single phase) flora & vegetation, Level 1 fauna.	8-12 May 2017 (Flora).

Report Title	Level of Assessment	Field Survey Timing
Broome Landfill Flora, Vegetation and Fauna Survey (Astron, 2017a).	Level 2 flora & vegetation, Level 1 fauna.	2-3 November 2016 (Flora & Fauna). 3-5 April 2017 (Flora).
Proposed Broome Landfill – Targeted Greater Bilby Survey (Astron, 2017b).	Targeted Greater Bilby survey.	Field: 4-6 April 2017.
Broome Motorplex Environmental Site Investigation (GHD, 2016)	Level 2 (single phase) flora & vegetation, Level 2 (single phase) and targeted fauna.	20 November 2015 (fauna) 14-15 December 2015 (fauna) 15-24 March 2016 (fauna) 18-24 March 2016 (flora & vegetation)
Broome North – Northern Portion (Area B). Preliminary Environmental Impact Assessment and Biological Survey (GHD, 2009).	Level 1 flora & vegetation and Level 1 vertebrate fauna.	Field: 3-6 June 2008.

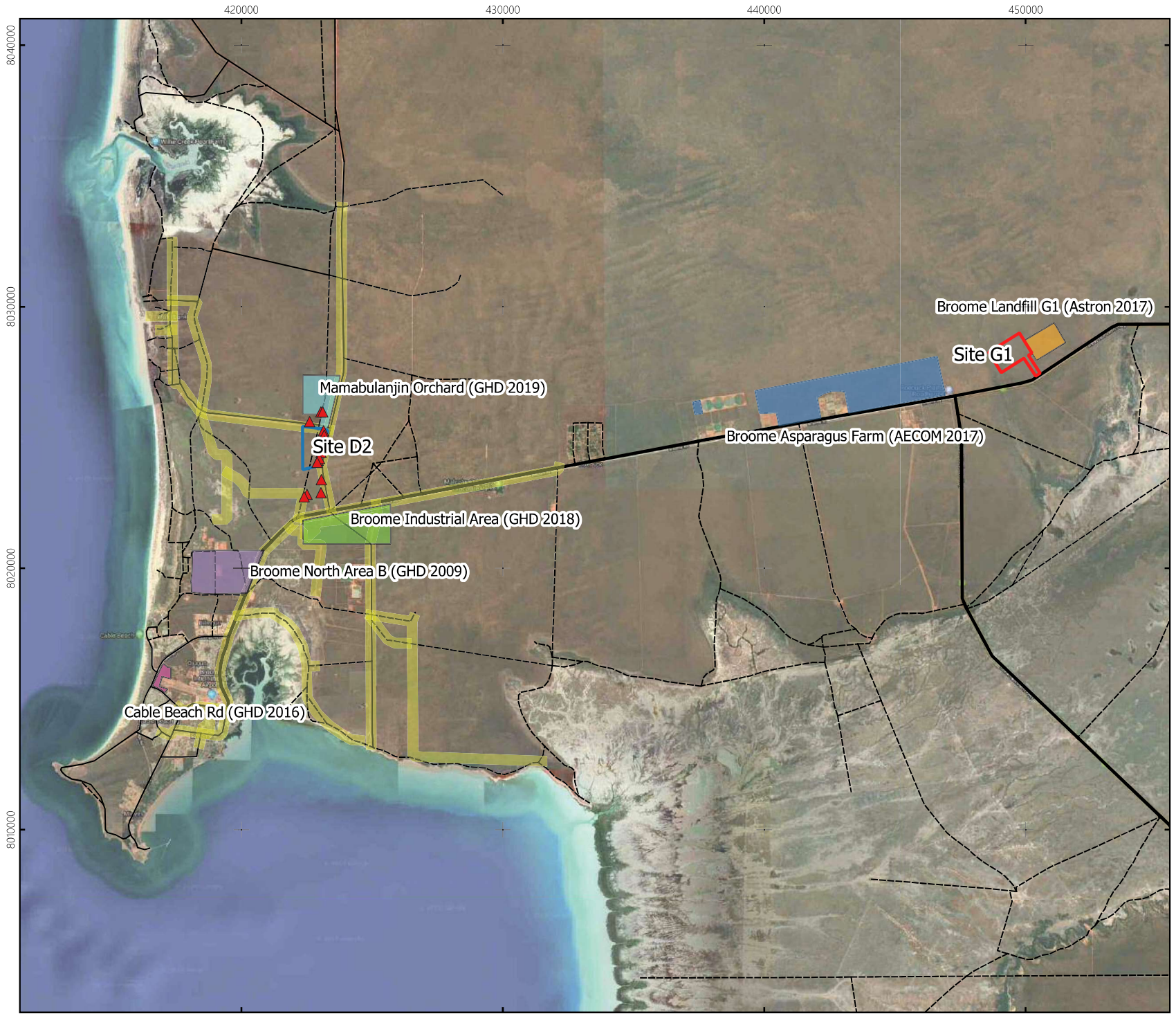
The results of the literature review identified species that are listed under the current legislative framework. A preliminary assessment of each significant species identified in the above database searches was completed prior to undertaking the field survey, with the following information provided:

- Conservation status (EPBC Act, BC Act, DBCA listing);
- Description of species habitat requirements and presence of this habitat within the study area;
- Summary of relevant records including source of record (DBCA, previous report etc) and accuracy of the record location; and

Likelihood of occurrence criteria assigned and justification of likelihood of occurrence that considers known habitats, survey effort etc. The likelihood of occurrence was determined based on the criteria outlined in Table 1.6.

Table 1.6: Likelihood of Occurrence Criteria

Likelihood	Flora & Vegetation Criteria	Fauna Criteria
Recorded	Species or community recorded within study area.	Species recorded within the Study Area within the previous ten years.
High	Species or community recorded in close proximity to study area and suitable habitat occurs in the study area.	Species recorded within or in proximity to the Study Area within the previous 20 years. Suitable habitat occurs in the Study Area.
Medium	Species or community recorded outside the study area but within 20°km suitable habitat occurs in the study area.	Species recorded within or in proximity to the Study Area more than 20 years ago. Species recorded outside the Study Area but within 40 km. Suitable habitat occurs in the Study Area.
Low	Species or community rarely or not recorded within 20°km of the study area. Suitable habitat does not occur within or in close proximity to the study area.	Species rarely or not recorded within 40 km of the Study Area. Suitable habitat does not occur within or in proximity to the Study Area.
Very Low	N/A	Species not recorded within 40 km despite multiple recent surveys. Suitable habitat does not occur within the Study Area. Species considered locally extinct.

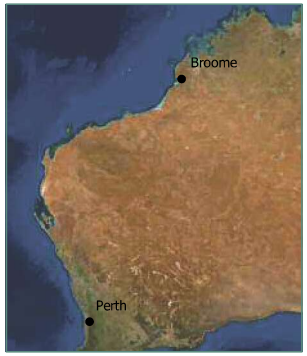


Legend

- Site D2
- Site G1
- Broome Motorplex Sites (GHD 2016)
- Targeted Corymbia (Environs Kimb 2018)
- Broome North Area B (GHD 2009)
- Broome Asparagus Farm (AECOM 2017)
- Broome Industrial Targeted (GHD 2018)
- Broome Landfill G1 RevA (Astron 2017)
- Cable Beach Rd East (GHD 2016)
- Mamabalanjin Orchard (GHD 2019)

Roads

- Principal Road
- Minor Road
- Track



0 1 2 3 4 5 km

Scale 1:200000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: DC Date: 14-01-2020

Survey Areas of the Literature Review

Proposed Waste Facility

Map 1.3

Prepared for
Shire of Broome | Talis

2. METHODOLOGY

2.1. Field Survey Timing

The survey was undertaken on 26 November 2019 by Spectrum Senior Ecologist, Chris Parker (1 day). Figure 1.2 shows the rainfall recorded for the 12 months prior to the survey (December 2018 to November 2019) compared to the median rainfall (1981-2010). The three-month period prior to the survey (September - November 2019) had characteristically very low rainfall after an unusually dry wet season (BOM 2019).

2.2. Project Team and Licenses

Spectrum Ecology staff involved with this assessment are listed in Table 2.1, along with their role, years of experience and relevant licenses.

Table 2.1: Project Team and Licences

Staff	Role	Experience	Licences
Chris Parker (Senior Ecologist)	Field Assessment, Reporting, Data analysis	10 years	Flora: FB6200 0009
Damien Cancilla (Principal Zoologist)	Reporting, Data Analysis, QA	12 years	N/A
Carmel Forrester (Botanist)	Reporting, Data Analysis	5 years	N/A

2.3. Reconnaissance Flora and Vegetation Assessment

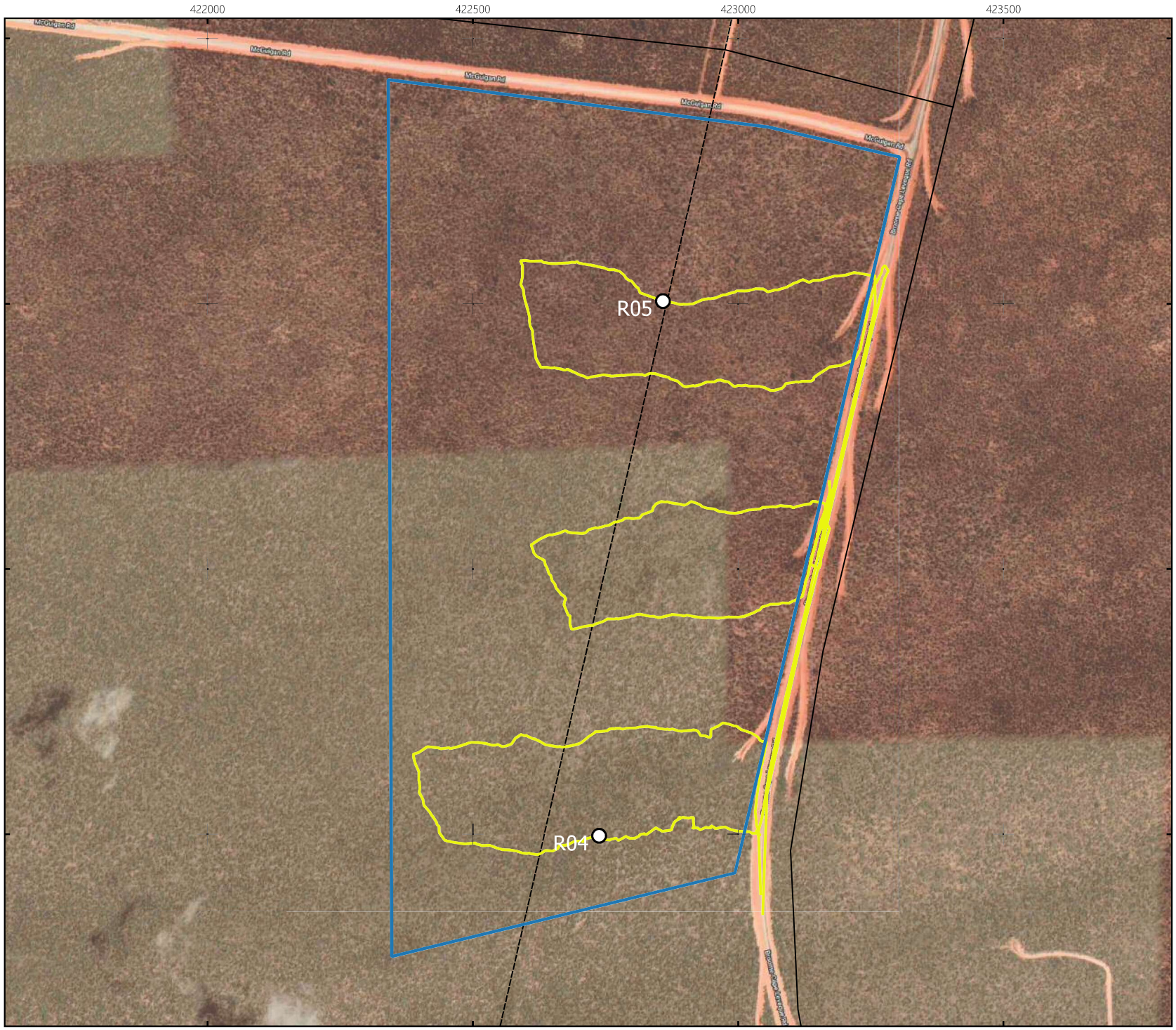
2.3.1. Field Methodology and Sampling Effort

A Reconnaissance level flora and vegetation assessment was conducted at the Study Areas. This was considered appropriate as it is the preliminary investigation into environmental values of the study area and some of the study areas and surrounding areas have been previously assessed as Detailed flora and vegetation survey and targeted flora survey. A second phase in the months following the wet season (February – April) will provide more clarity on populations of Priority Flora with High Likelihood of occurrence (see Section 4.1 for further discussion).

A combination of relevés, traverses and opportunistic sampling is appropriate for reconnaissance level surveys as stipulated in the guidance statement (EPA 2016b) and these survey techniques are described in Table 2.2. Comprehensive relevé data collection information is included in Appendix B. Information on vegetation mapping was collected at relevé sites and also opportunistically whilst traversing through the Study Areas. During the survey, five relevés were sampled within the study areas; including two relevés at D2 Study Area, three relevés in G1 Study Area (site information is described in Appendix C). Relevés, mapping sites, traverses and vehicle tracks are mapped in Map 2.1.

Table 2.2: Reconnaissance Flora and Vegetation Assessment Survey Technique

Survey Technique	Description
Relevés	Relevés are a low intensity survey technique for gathering information for low-intensity flora and vegetation surveys. Information collected at each relevé includes: • Site code, date, location, botanist; • A photograph; • Vegetation condition and disturbances (including fire); • Landform including; slope, soil, rock type, aspect; and • Flora and vegetation information; dominant cover, structure and species count where necessary.
Traverses	A traverse is an unmarked route along which data is collected. Traverses are useful for identifying the boundaries and characteristics of vegetation types, selecting sites for detailed survey, and targeting significant flora or vegetation. Information recorded along a traverse is as for the relevé, with the addition of noting vegetation changes and relationships between vegetation and substrate.
Opportunistic Sampling	Flora and vegetation not recorded through other sampling methods was opportunistically sampled as encountered in the study area. Opportunistic sampling also included recording locations of significant, introduced (weed) and unknown species.
Targeted Sampling	Areas likely to support significant flora or vegetation were targeted during the survey, including areas with existing records of significant flora. Areas were selected based on existing records from database searches, geology, vegetation mapping and known Environmentally Sensitive Areas. Where possible, unusual and restricted geological features within the study area were sampled. When potentially significant flora were encountered during the survey, sufficient information was recorded to complete a Threatened and Priority Flora Report Form (TPRF).

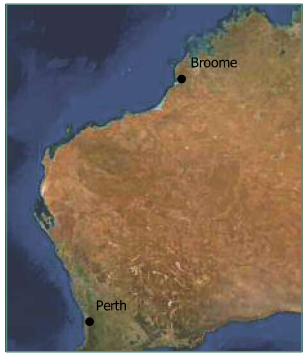


Legend

- Site D2
- Releve Site Locations
- Transects Walked During the Survey

Roads

- Principal Road
- Minor Road
- Track



0 0.1 0.2 0.3 km

Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

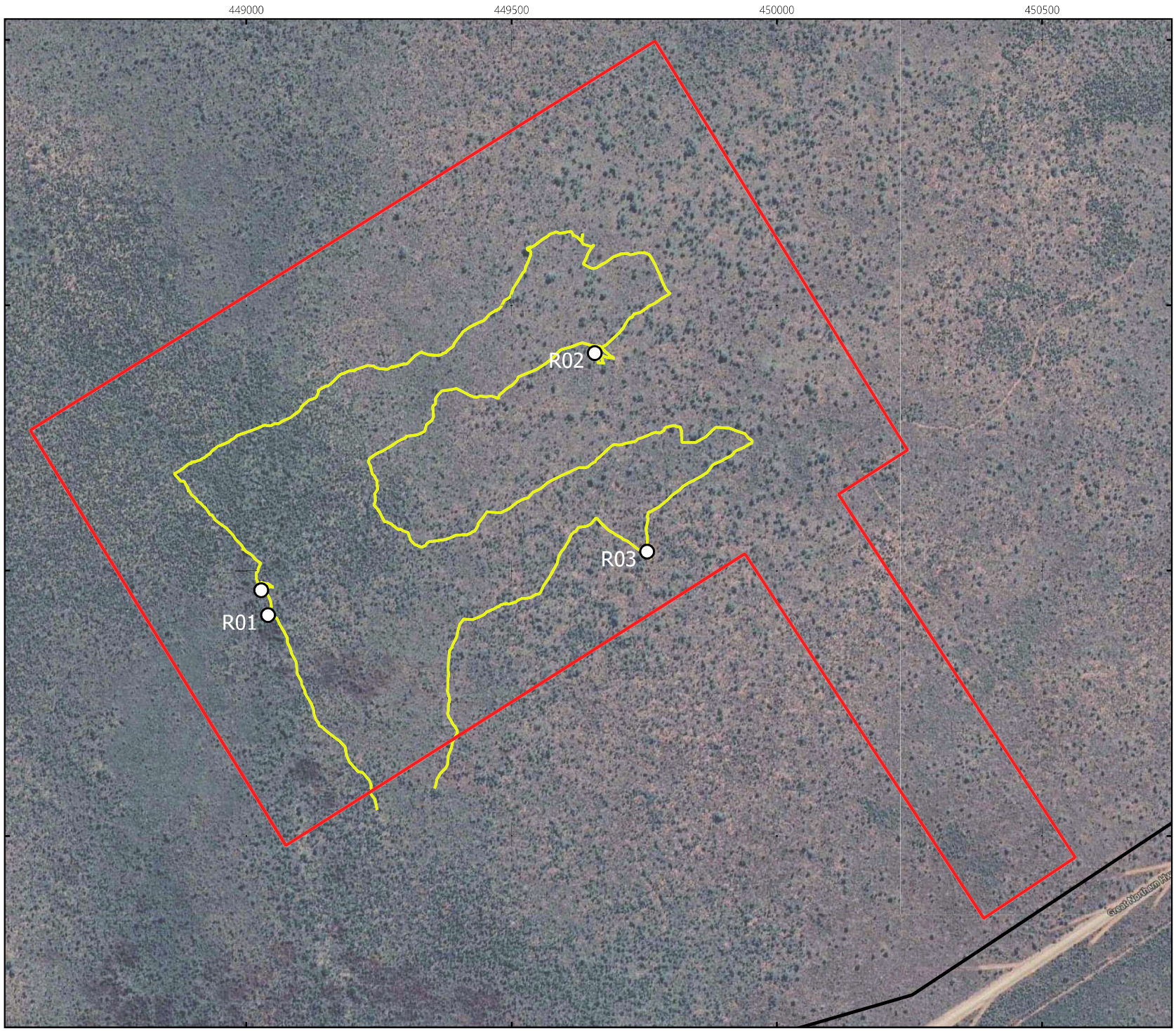
Author: CF Approved: DC Date: 15-01-2020

Flora and Vegetation Sampling Effort at the D2 Study Area

Proposed Waste Facility

Map 2.1

Prepared for
Shire of Broome | Talis

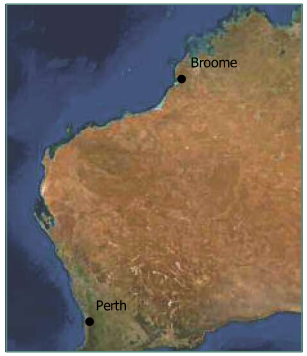


Legend

- Site G1
- Releve Site Locations
- Transects Walked During the Survey

Roads

- Principal Road
- Minor Road
- Track



0 0.1 0.2 0.3 km

Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: DC Date: 15-01-2020

Flora and Vegetation Sampling Effort at the G1 Study Area

Proposed Waste Facility

Map 2.2

Prepared for
Shire of Broome | Talis

2.3.2. Vegetation and Condition Mapping

The data collected from relevés, traverses, as well as general field notes, observations and aerial photography were used to map the vegetation across the study areas. Vegetation was classified structurally based on the dominant species. The vegetation classification is consistent with NVIS Level V – association vegetation descriptions (referred to as a 'vegetation unit' for the local scale in this report). This level of description provides information on the dominant growth form, height and cover for up to three species for each of the upper, mid and ground strata (ESCAVI, 2003).

Vegetation condition was recorded at relevés and where areas of different vegetation condition were observed from both ground truthing and aerial imagery. The vegetation condition was mapped across the study area at the same scale as the vegetation mapping. Vegetation condition ratings follow the scale recommended for the interzone botanical province (EPA 2016b), summarised in Table 2.3.

Table 2.3: Vegetation Condition Scale and Criteria

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

2.3.3. Nomenclature, Specimen Identification and Lodgement

Flora nomenclature used in this report is consistent with the Western Australian Herbarium's plant census, provided on FloraBase (Western Australian Herbarium, 2019) and is current at the time of report preparation.

Flora specimens were collected of any suspected or known significant flora and to confirm species recorded during the relevés for vegetation mapping. Specimens were identified using the appropriate taxonomic keys and where required, relevant taxonomic experts at the Western Australian Herbarium.

Specimens are vouchered with the Western Australian Herbarium as per guidance; when they represent new populations of threatened or priority flora, new occurrences of TECs or PECs, individuals that have atypical characteristics, or bioregional range extensions.

2.3.4. Significant Flora and Vegetation Definitions

Flora and vegetation can be considered significant for a range of reasons.

Significant flora can include:

- Being identified as threatened (state listed WC Act and/or nationally listed EPBC Act);
- Being identified as priority species: Priority 1 to 4 (DBCA 2019);
- Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly, at the extremes of range recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation can include:

- Identified as Threatened Ecological Community (TEC) (state listed WC Act and/or nationally listed EPBC Act);
- Priority Ecological Community (PEC) (DBCA 2017);
- Restricted distribution;
- Degree of historical impact from threatening processes;
- A role as a refuge; and
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

2.3.5. Limitations and Constraints

Survey specific limitations and constraints for the flora and vegetation reconnaissance assessment for the Study Areas are discussed in Table 2.4.

Table 2.4: Limitations and Constraints of the Study – Flora

Limitation	Constraint	Comment
Availability of contextual information at a regional and local scale.	No	There were several surveys identified in the Literature Review and available from the IBSA database in close proximity (20 km) to the study areas (see Table 1.5). These surveys gave excellent local and regional contextual information, particularly for conservation significance. For historical context, Beard mapping has been used, however this mapping is conducted at a coarse scale (1:250,000) and can only provide an approximate comparison.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	No	Botanist Chris Parker has ten years experience in conducting botanical surveys throughout Western Australia, including experience within the Dampier Peninsula and Kimberly bioregion.
Restrictions to, or functionality of survey equipment and tools to complete the flora and vegetation assessment.	No	There were no restrictions to or compromised functionality of survey equipment or tools that would adversely effect the flora and vegetation equipment during the current survey.

Limitation	Constraint	Comment
Proportion of flora recorded and/or collected, any identification issues.	Somewhat	Proportion of flora collected was consistent with expectations for this type of survey and survey timing in the context of other surveys of a similar level and seasonality. There were four Priority Flora species (three ephemeral and one tree), listed with High Likelihood to occur in the study areas and not expected to be flowering at the time of the survey. They are: • *Corymbia paractia* (P1); • *Jacquemontia* sp. Broome (P1); • *Glycine pindanica* (P3); and • *Polymeria* sp. Broome (P3). Without adequate floristic material these four Priority Flora are either absent (existing in the substrate as root stock or seed) or difficult to distinguish from similar species. Presence of these taxa is more likely to be confirmed during surveys conducted in the months directly following the wet season (February to April). This has somewhat limited the results of the flora recorded during the survey. Plants were identified by taxonomist Udani Sirisena who has botanical and taxonomic experience throughout Western Australia. Where there were complexities specialist taxonomists at the Western Australian herbarium were consulted. Six specimens were unable to be confirmed or left with a query on their species confirmation due to poor quality material. This can also be contributed to the seasonal conditions.
Survey effort and extent.	No	Prior to the field survey, quadrat sites were selected to represent the diversity of vegetation and geology present at the study area. This was sufficient to map and classify the vegetation of the study area for the Reconnaissance assessment. All the vegetation types identified are common for this area. The Study Area was adequately assessed in accordance with the Guidance Statement Guidelines
Access restrictions within the survey area.	No	There were no access limitations in the flora and vegetation survey.
Survey timing, rainfall, season of survey.	Yes	The field survey timing was considered appropriate season for a flora and vegetation survey conducted in the Kimberley Botanical Province. However conditions were very dry and the wet season preceding the survey received less than half the median rainfall. This effected the flowering of *Corymbia paractia*. Without adequate floristic material, this taxa cannot be conclusively identified. Six specimens were unable to be conclusively identified due to poor quality material. Four priority flora were either not expected to be flowering at the time of the survey or not flowering due to seasonal conditions. This placed a limitation on confirming presence of Priority flora with a High Likelihood of occurrence.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No	Some areas of the G1 Study Area were recorded as recently burnt. However adequate interpretation of flora and vegetation composition was obtained in the context of a Reconnaissance Survey.

2.4. Level 1 Fauna Assessment

The terrestrial fauna survey was consistent with a Level 1 survey as described in Technical Guidance: Terrestrial Fauna Surveys (EPA 2016c) and Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016d). The guidance suggests selective low-intensity sampling of the fauna and fauna habitats to verify the accuracy of the desktop assessment, with a focus on any conservation significant fauna identified as likely to be present.

2.4.1. Fauna Habitat Mapping

Fauna habitat mapping identifies areas of vegetation and land features that are distinguishable from other areas. Typically, each fauna habitat supports a characteristic fauna assemblage that is adapted to the features of the fauna habitat. Fauna habitat types are identified and described for each bore field based on the following information:

- General vegetation type (Shepherd, Beeston and Hopkins, 2001);
- Vegetation units mapped within the study area;
- Vegetation structure;
- Landforms;
- Geological units;
- Soil substrate;
- Aerial imagery;
- Fauna assemblage; and
- Field observations.

2.4.2. Limitations and Constraints

Limitations and constraints of the fauna and fauna habitat assessment are summarised in Table 2.5.

Table 2.5: Limitations and Constraints of the Study – Fauna

Limitation	Constraint	Comment
Availability of data and information	No	There were no restrictions on the required information, and all the relevant databases were accessed.
Competency/experience of the survey team, including experience in the bioregion survey	No	Senior Ecologist Chris Parker has 8 years of experience completing ecological surveys, plus extensive experience surveying fauna in the Dampierland region of WA in his previous role working with Yawuru country managers.
Scope of the survey, e.g. where faunal groups were excluded from the survey	No	The field survey consisted of a level 1 fauna survey. No constraints were experienced completing the survey.
Timing, weather and season.	No	The assessment of fauna habitats and recording of secondary evidence of fauna species was not compromised. Targeted searches for the Greater Bilby can be completed at any time of the year (DSEWPaC 2011; Southgate *et al.*, 2018).
Disturbances which may have affected results. (e.g. fire, flood)	No	No disturbances were recorded during the survey.
Proportion of fauna identified, recorded or collected.	No	All vertebrate fauna species encountered were identified in the field. Level 1 survey methods do not require the identification of all fauna species present within the study area.
Adequacy of the survey intensity and the proportion of the survey achieved (e.g. extent to which the area was surveyed).	No	A level 1 survey was adequate to identify the presence of the threatened fauna and the fauna habitat present within the study area. Sufficient information is available to determine likely habitat use by other conservation significant fauna species. All components of a level 1 fauna survey were completed.
Access problems.	No	No access restrictions were experienced within the study area.
Problems with data and analysis, including sampling biases.	No	No limitations were experienced during the data analysis and sampling.
Other	No	

2.5. Data for the Index of Biodiversity Survey's for Assessments (IBSA)

The Environmental Protection Authority has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package.

All survey data for the study areas has been provided electronically with this report to comply with IBSA data package standards.

3. RESULTS

3.1. Flora Desktop Study

Twenty-three significant taxa were identified during the flora database searches and Literature Review. These are summarised in Table 3.1 with the likelihood of occurrence analysis provided in Appendix A. Records are mapped in Map 3.1. Coordinates of mapped records are available upon request.

Table 3.1: Significant Flora Likelihood of Occurrence from Database Searches and Literature Review

Likelihood	Cons Sig	Species
Recorded	Priority 1	*Corymbia paractia*
High	Priority 1	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)
	Priority 3	*Glycine pindanica, Polymeria* sp. Broome (K.F. Kenneally 9759), *Seringia katatona, Terminalia kumpaja*
Medium	Threatened	*Seringia exastia*
	Priority 1	*Ipomoea tolmerana* subsp. *occidentalis*
	Priority 3	*Aphyllodium glossocarpum, Bonamia oblongifolia, Goodenia byrnesii, Stylidium pindanicum, Tephrosia pedleyi, Tetragonia coronata*
Low	Priority 1	*Thespidium basiflorum, Aphyllodium parvifolium*
	Priority 2	*Gomphrena pusilla*
	Priority 3	*Fuirena incrassata, Acacia monticola* x *tumida* var. *kulparn, Lophostemon grandiflorus* subsp. *grandiflorus, Nymphoides beaglensis, Stylidium costulatum*
	Priority 4	*Pittosporum moluccanum*

3.2. Vegetation Desktop Study

Twelve ecosystems of conservation significance consisting of 118 records were identified from the database search. These include:

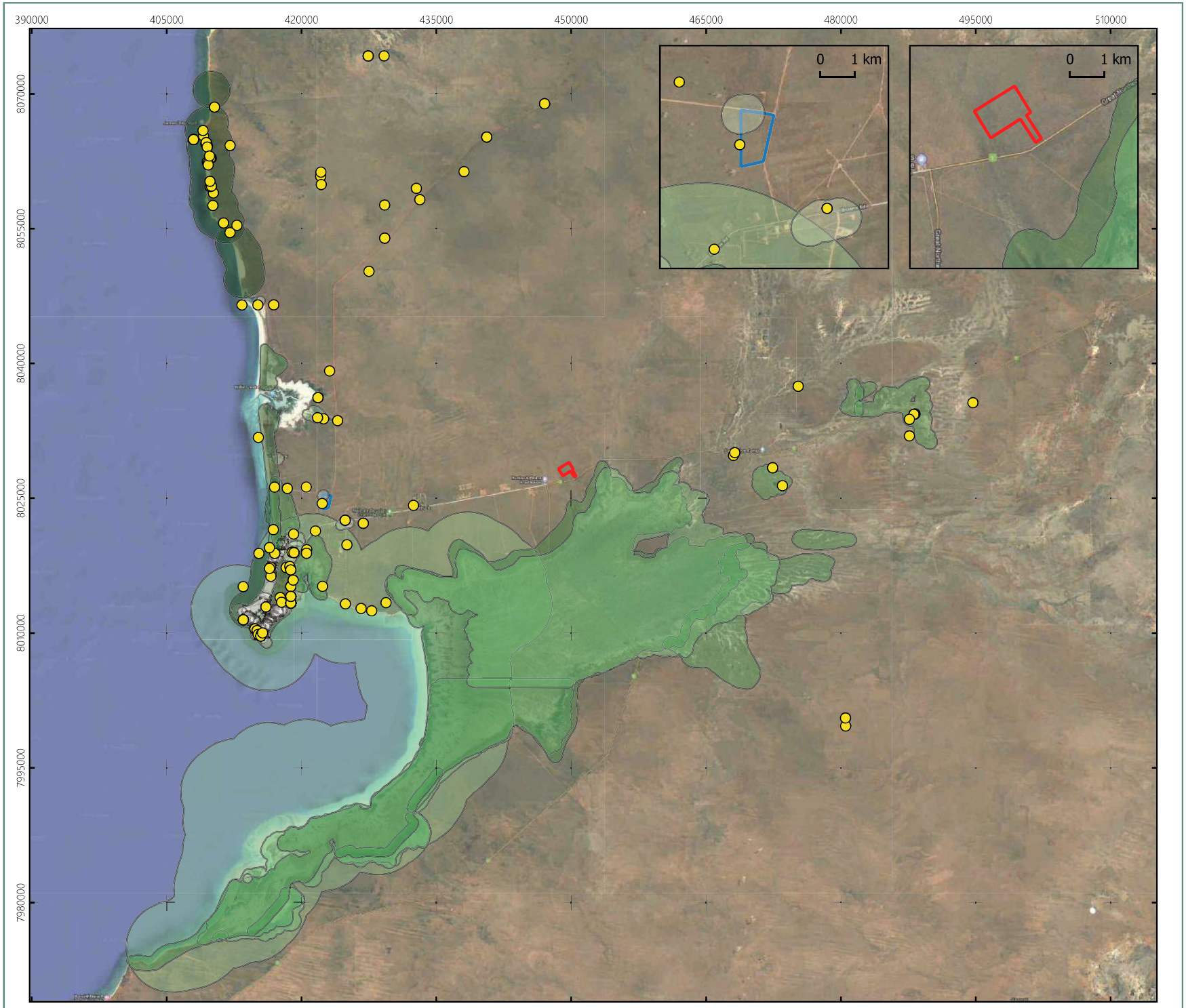
- Monsoon (vine) thickets on coastal sand dunes of the Dampier Peninsula, federally listed as Threatened and state listed as Vulnerable;
- Roebuck bay mudflats, state listed as Vulnerable;
- 87 records of Priority 1 communities;
- 17 records of Priority 3; and
- One record of a Priority 4 community.

These Priority and Threatened Ecological Communities are listed in Table 3.2 and mapped in Map 3.1.

Table 3.2: Priority and Threatened Ecological Communities Recorded from the Database Searches.

Name	Description	Conservation Category^	No. of records	Proximity to the D2 Study Area	Proximity to the G1 Study Area
Vine thickets	Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula	Vulnerable^ Threatened+	11	closest record is 7 km south west	<20 km
Roebuck Bay mudflats	Species-rich faunal community of the intertidal mudflats of Roebuck Bay	Vulnerable^	1	500 m south	8 km south west
Corymbia paractia	*Corymbia paractia* dominated community on dunes	Priority 1^	65	Adjacent to the north and west of study area and upto 15 km to the south west	<20 km
Dwarf pindan heath	Dwarf pindan heath community of Broome coast	Priority 1^	2	14 km to the south west	<20 km
Mangarr (Minyjuru)	Relict dune system dominated by extensive stands of Minyjuru (Mangarr) *Sersalisia* (formerly *Pouteria*) *sericea*.	Priority 1^	19	closest record within study area, and 2 - 7 km northwest, southwest, southeast.	<20 km
Vegetation Association 770	Kimberley Vegetation Association 770	Priority 1^	1	4.8 km west	<20 km
Eighty Mile Land System	Eighty Mile Land System	Priority 3^	1	more than 20 km	<20 km
Roebuck Land System	Roebuck Land System	Priority 3^	3	11 km to the south west	2.8 km south east
Vegetation Association 37	Kimberley Vegetation Association 37	Priority 3^	3	more than 20 km	<20 km
Vegetation Association 67	Kimberley Vegetation Association 67	Priority 3^	6	more than 20 km	<20 km
Vegetation Association 73	Kimberley Vegetation Association 73	Priority 3^	4	3 km to the south and west, and 10 km to the south east	2.4 km south east
Nimalarica Claypan	Nimalarica Claypan Community (prevously Nimalaica)	Priority 4^	1	8 km north	<20 km

^ - State Protected. + - Commonwealth Protected

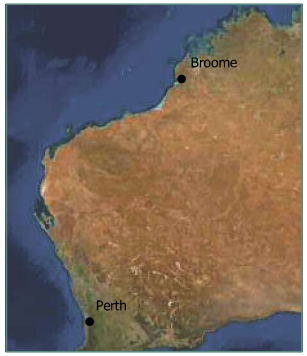


Legend

- Site D2
- Site G1
- Conservation Significant Flora

Conservation Significant Vegetation

- Corymbia paractia
- Dwarf pindan heath
- Eighty Mile Land System
- Mangarr (Minyjuru)
- Nimalarica Claypan
- Roebuck Bay mudflats
- Roebuck Land System
- Vegetation Association 37
- Vegetation Association 67
- Vegetation Association 73
- Vegetation Association 770
- Vine thickets



0 3 6 9 12 km

Scale 1:570000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: AH Date: 15-01-2020

DBCA Flora and Vegetation Database Search Results

Proposed Waste Facility

Map 3.1

Prepared for
Shire of Broome | Talis

3.3. Flora

A total of 45 taxa from 18 families and 34 genera were recorded during the survey. The most species rich family was Fabaceae with nine taxa. The most species rich genus were *Acacia* with four taxa and *Coymbia* with three taxa. A representative species list is included in Appendix D. No introduced species were recorded during the survey. No Threatened or Priority Flora were recorded during the field survey.

Several surveys from the Literature Review were conducted with excellent seasonal timing, assessing vegetation in the months directly following the wet season, February to April. Ten Priority Flora were identified from the Database searches and Literature Review surveys to occur in the vicinity (20 km) of the study areas; three Priority 1, four Priority 3 and three taxa that have since been delisted:

- *Aphyllodium parvifolium* (P1), Medium Likelihood of occurrence;
- *Corymbia paractia* (P1), Previously Recorded;
- *Jacquemontia* sp. Broome (P1), High Likelihood of occurrence;
- *Glycine pindanica* (P3), High Likelihood of occurrence;
- *Polymeria* sp. Broome (P3), High Likelihood of occurrence;
- *Seringia katatona* (P3), High Likelihood of occurrence;
- *Terminalia kumpaja* (P3), High Likelihood of occurrence;
- *Phyllanthus eremicus* (delisted);
- *Pterocaulon intermedium* (delisted); and
- *Triodia caelestialis* (delisted).

The literature review found *Corymbia paractia* (P1) was previously recorded from the northern and eastern boundaries of the D2 Study Area during. Five Priority Flora found during the desktop survey are listed with a High Likelihood of occurrence in the study areas (see Appendix A). Significant and introduced flora information is detailed for each of the study areas, below.

3.3.1. D2 Study Area

There were no introduced species recorded during the survey at the D2 Study Area.

There were no Threatened flora species recorded during the survey at the D2 Study Area.

There were no Priority flora recorded during the current field survey at the D2 Study Area.

A recent Targeted flora survey for Priority One Flora, *Corymbia paractia* identified several locations of this species to occur on the boundary north and east of the D2 Study Area along the roadside reserves (Environs Kimberley, 2018). *Corymbia paractia* is recorded at the boundary and highly likely to occur throughout the D2 Study Area, considering the geology, presence of associated vegetation and records at the boundary of the D2 Study Area (see Appendix A and Map 3.2).

The field survey could not confirm the presence of *C. paratica* at the D2 Study Area due to insufficient floristic material. When flowering and fruiting material is absent, the Priority One species is difficult to distinguish from the co-occurring, dominant species *C. flavescens*. Although the survey was undertaken during the optimal flowering time for these species, dry seasonal conditions resulted in no individuals observed flowering. Below average rainfall in the year preceding the survey may have contributed to insufficient floristic material (see Section 1.4).

Five Priority Flora with a High Likelihood of occurrence are known to occur in the vicinity (20km) of the D2 Study Area, as identified from the desktop survey. They are illustrated in Map 3.2 and listed below:

- *Jacquemontia* sp. Broome (P1);

- *Glycine pindanica* (P3);
- *Polymeria* sp. Broome (P3);
- *Seringia katatona* (P3); and
- *Terminalia kumpaja* (P3).

3.3.2. G1 Study Area

There were no introduced species recorded during the survey at the G1 Study Area.

There were no Threatened flora species recorded during the survey at the G1 Study Area.

There were no Priority flora recorded during the survey at the G1 Study Area.

Two Priority flora are known to occur in the vicinity (20 km) of the G1 Study Area as identified from the desktop survey. They are illustrated in Map 3.3 and listed below;

- *Jacquemontia* sp. Broome (P1); and
- *Polymeria* sp. Broome (P3).

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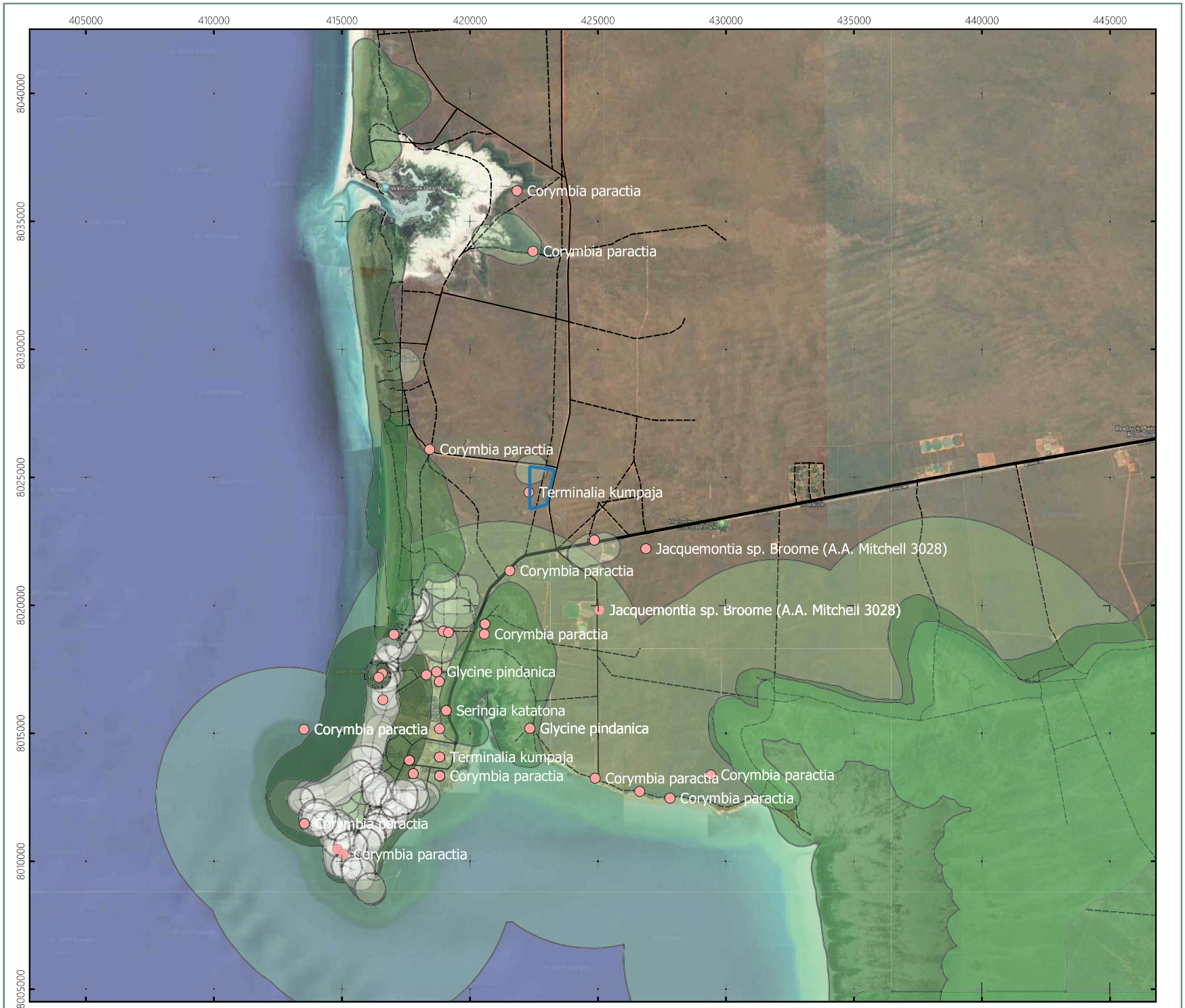


Legend

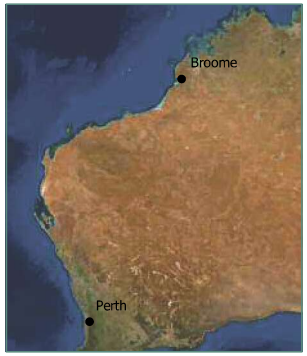
- Site D2

Flora from the Database Search

- High Likelihood of Occurence

Broome_Spectrum_TecPecSearchResults_17122019

- Corymbia paractia
- Dwarf pindan heath
- Eighty Mile Land System
- Mangarr (Minyjuru)
- Nimalarica Claypan
- Roebuck Bay mudflats
- Roebuck Land System
- Vegetation Association 37
- Vegetation Association 67
- Vegetation Association 73
- Vegetation Association 770
- Vine thickets



0 1 2 3 4 km

Scale 1:200000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

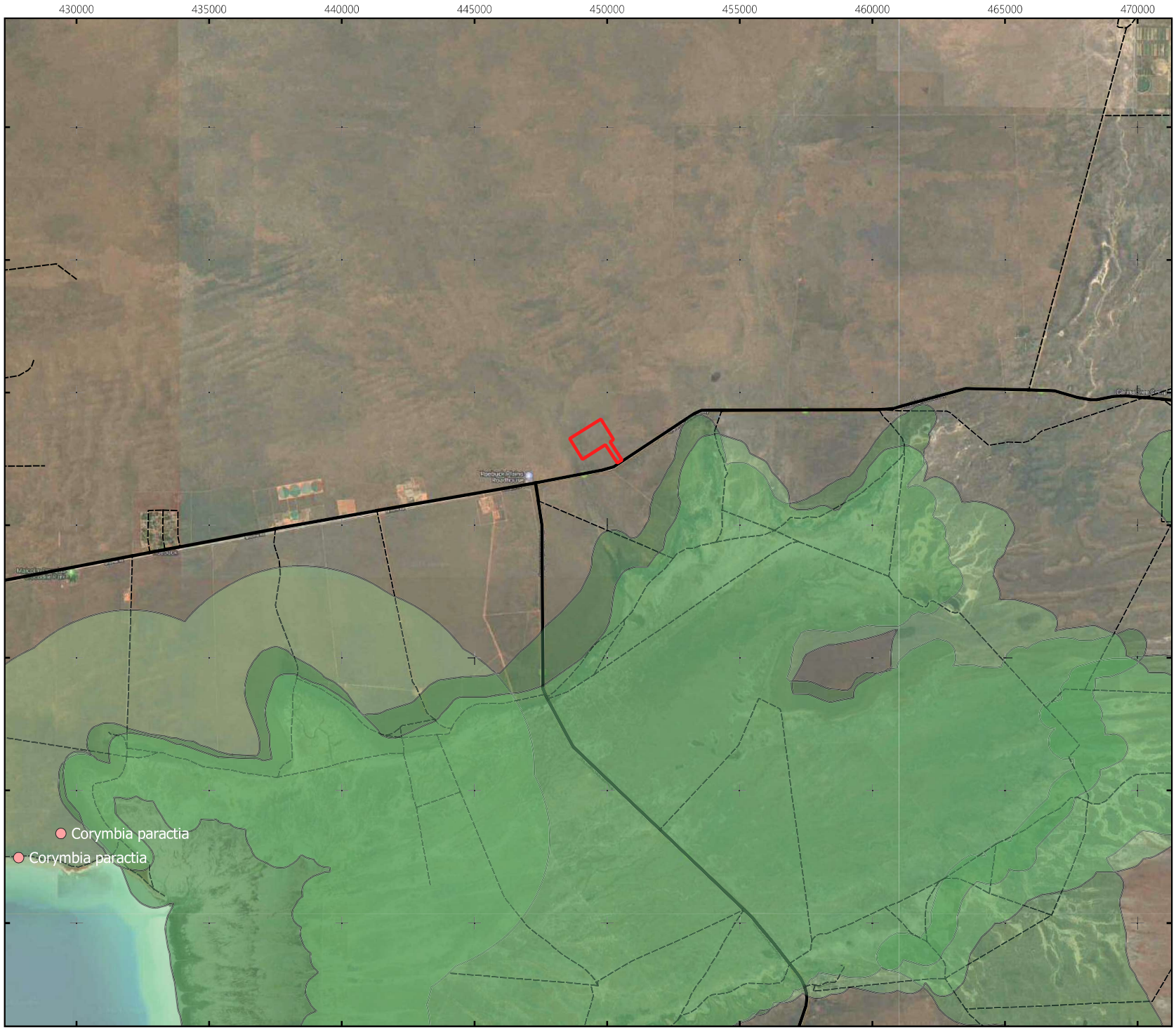
Author: CF Approved: DC Date: 15-01-2020

Significant Flora and Vegetation known from the Vicinity of the D2 Study Area

Proposed Waste Facility

Map 3.2

Prepared for
Shire of Broome | Talis



Legend

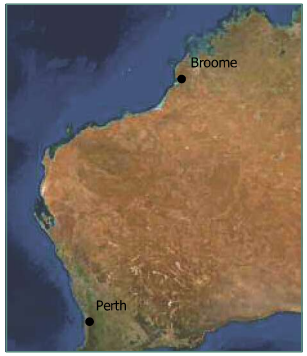
- Site G1

Flora from the Database Search

- High Likelihood of Occurence

Broome_Spectrum_TecPecSearchResults_17122019

- Corymbia paractia
- Dwarf pindan heath
- Eighty Mile Land System
- Mangarr (Minyjuru)
- Nimalarica Claypan
- Roebuck Bay mudflats
- Roebuck Land System
- Vegetation Association 37
- Vegetation Association 67
- Vegetation Association 73
- Vegetation Association 770
- Vine thickets



0 1 2 3 4 km

Scale 1:200000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: DC Date: 15-01-2020

Significant Flora and Vegetation known from the Vicinity of the G1 Study Area

Proposed Waste Facility

Map 3.3

Prepared for
Shire of Broome | Talis

3.4. Vegetation

Three vegetation types were recorded from the study areas (two in G1 and one in D2). Each are common in the landscape and reflect the 750.1 Vegetation Association Unit from the Pre-European Beard mapping.

Vegetation types were described from the field survey identified on Pindan flat plains include:

1. *Corymbia greeniana* isolated trees over *Acacia eriopoda* open shrubland over *Chrysopogon fallax* and *Triodia* species isolated tussock and hummock grasses.
2. *Bauhinia cunninghamii* open woodland over *Acacia eriopoda* and *A. platycarpa* sparse shrubland over *Grewia rustifolia* and *Pterocaulon intermedium* isolated heath shrubs over *Chrysopogon fallax* isolated tussock grasses.
3. *Corymbia flavescens* and *C. greeniana* (+/- *Brachychiton diversifolius* ssp. *diversifolius, Bauhinia cunninghamii)* open woodland over *Acacia eriopoda* sparse shrubland over *Sorghum plumosum* sparse tussock grassland.

Table 3.3 outlines each of the vegetation types and details which types were present in each of the study areas.

Table 3.3: Vegetation Types Described at the Study Areas

Vege Type	Description	Sites	Presence in D2 Study Area	Presence in G1 Study Area	Representative Photograph
Pindan Flat Plain					
1	*Corymbia greeniana* isolated trees over *Acacia eriopoda* open shrubland over *Chrysopogon fallax* and *Triodia* species isolated tussock and hummock grasses.	R04 R05	Present	Not Present	
2	*Bauhinia cunninghamii* open woodland over *Acacia eriopoda* and *A. platycarpa* sparse shrubland over *Grewia rustifolia* and *Pterocaulon intermedium* isolated heath shrubs over *Chrysopogon fallax* isolated tussock grasses.	R01	Not Present	Present	
3	*Corymbia flavescens* and *C. greeniana* (+/- *Brachychiton diversifolius* ssp. *diversifolius, Bauhinia cunninghamii)* open woodland over *Acacia eriopoda* sparse shrubland over *Sorghum plumosum* sparse tussock grassland.	R02 R03	Not Present	Present	

3.4.1. D2 Study Area

One Vegetation Type was described from the D2 Study Area; Vegetation Type 1. This vegetation type was derived from flat Pindan Plains and is mapped in Map 3.4.

1. *Corymbia greeniana* isolated trees over *Acacia eriopoda* open shrubland over *Chrysopogon fallax* and *Triodia* species isolated tussock and hummock grasses.

3.4.1.1. Significant Vegetation

No vegetation communities identified as a Threatened Ecological Communities were recorded at the D2 study area.

The north-western corner of the D2 Study Area intersects the Priority 1 Priority Ecological Community Mangarr (Minyjuru) (Unique Code 17327). This community represents the relict dune system dominated by extensive stands of Miniyjuru (Mangarr) *Sersalisia* (formerly *Pouteria*) *sericea*.

Vegetation Type 1 is the known habitat for Priority 1 species, *Corymbia paractia*, this vegetation type is considered significant as it plays a role in refuge for conservation significant flora.

3.4.1.2. Vegetation Condition

The vegetation condition at the D2 Study Area was recorded entirely as Excellent and is mapped in Map 3.5. There were little to no signs of disturbance.

3.4.2. G1 Study Area

Two Vegetation Types were described from the G1 Study Area; Vegetation Types 2 and 3. These vegetation types were derived from flat Pindan Plains and are mapped in Map 3.6.

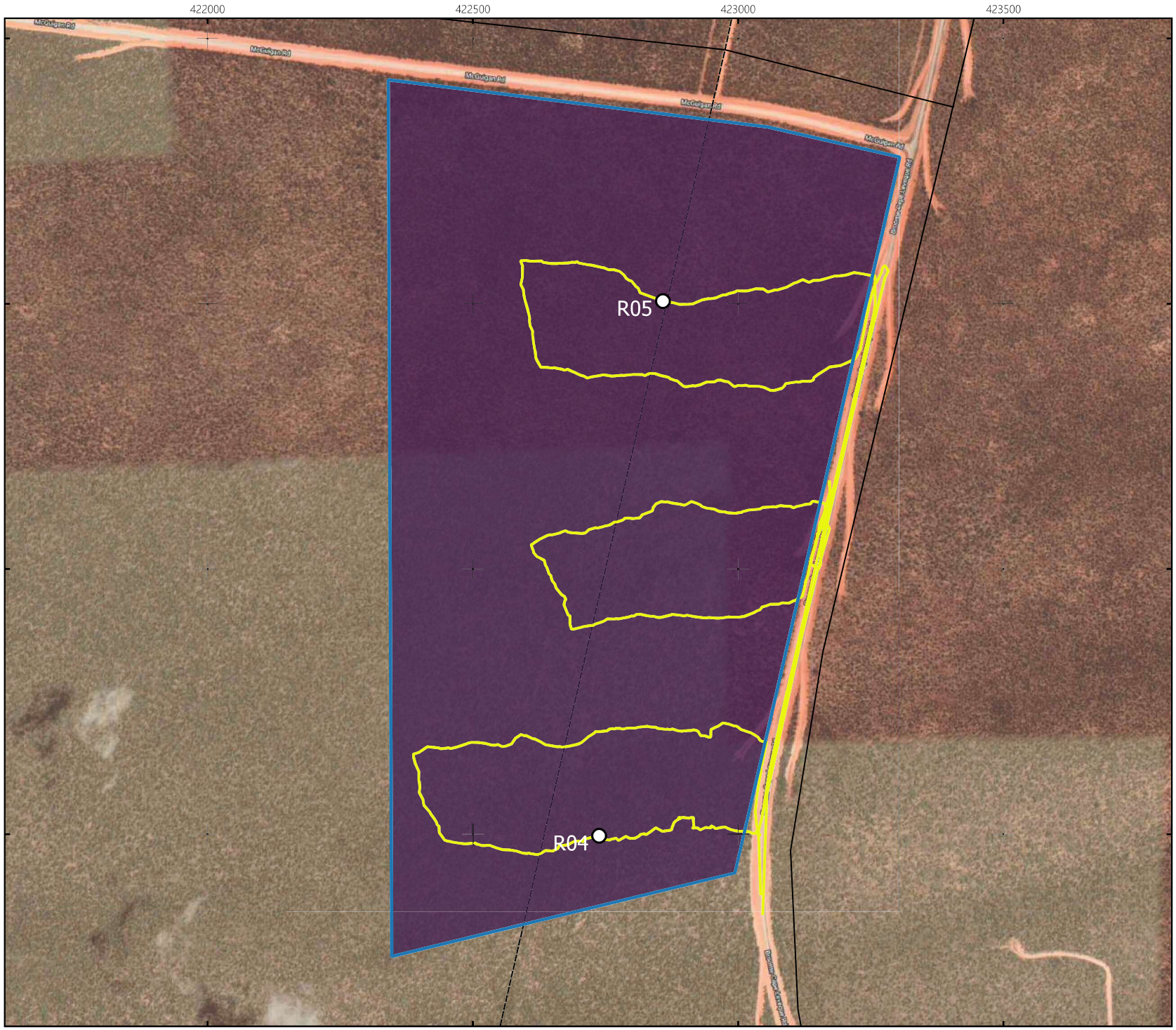
2. *Bauhinia cunninghamii* open woodland over *Acacia eriopoda* and *A. platycarpa* sparse shrubland over *Grewia rustifolia* and *Pterocaulon intermedium* isolated heath shrubs over *Chrysopogon fallax* isolated tussock grasses.
3. *Corymbia flavescens* and *C. greeniana* (+/- *Brachychiton diversifolius* ssp. *diversifolius*, *Bauhinia cunninghamii)* open woodland over *Acacia eriopoda* sparse shrubland over *Sorghum plumosum* sparse tussock grassland.

3.4.2.1. Significant Vegetation

There were no vegetation types identified as a TEC/PEC or significant due to historical impact from threatening processes, or which provide a function to maintain ecological integrity of a significant ecosystem.

3.4.2.2. Vegetation Condition

The vegetation condition at the G1 Study Area was recorded entirely as Excellent and is mapped in Map 3.7. There were little to no signs of disturbance. Signs of fire were recorded throughout, with approximately 80% of the area burnt as recently as within a year and with the remainder being burnt less than 5 years ago. Low grazing in the western end of the G1 Study Area near R01 was noted. Vegetation structure remains intact.



Legend

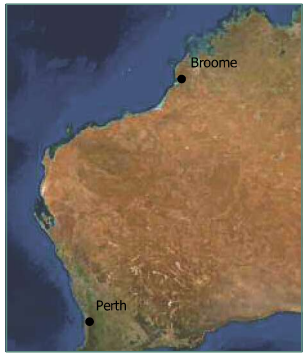
- Site D2
- Releve Site Locations
- Transects Walked During the Survey

Vegetation Types

- 1: C. greeniana over Acacia open shrubland
- 2: Bauhinia open woodland over Acacia shrubland
- 3: C. flavescens and C. greeniana open woodland

Roads

- Principal Road
- Minor Road
- Track



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Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

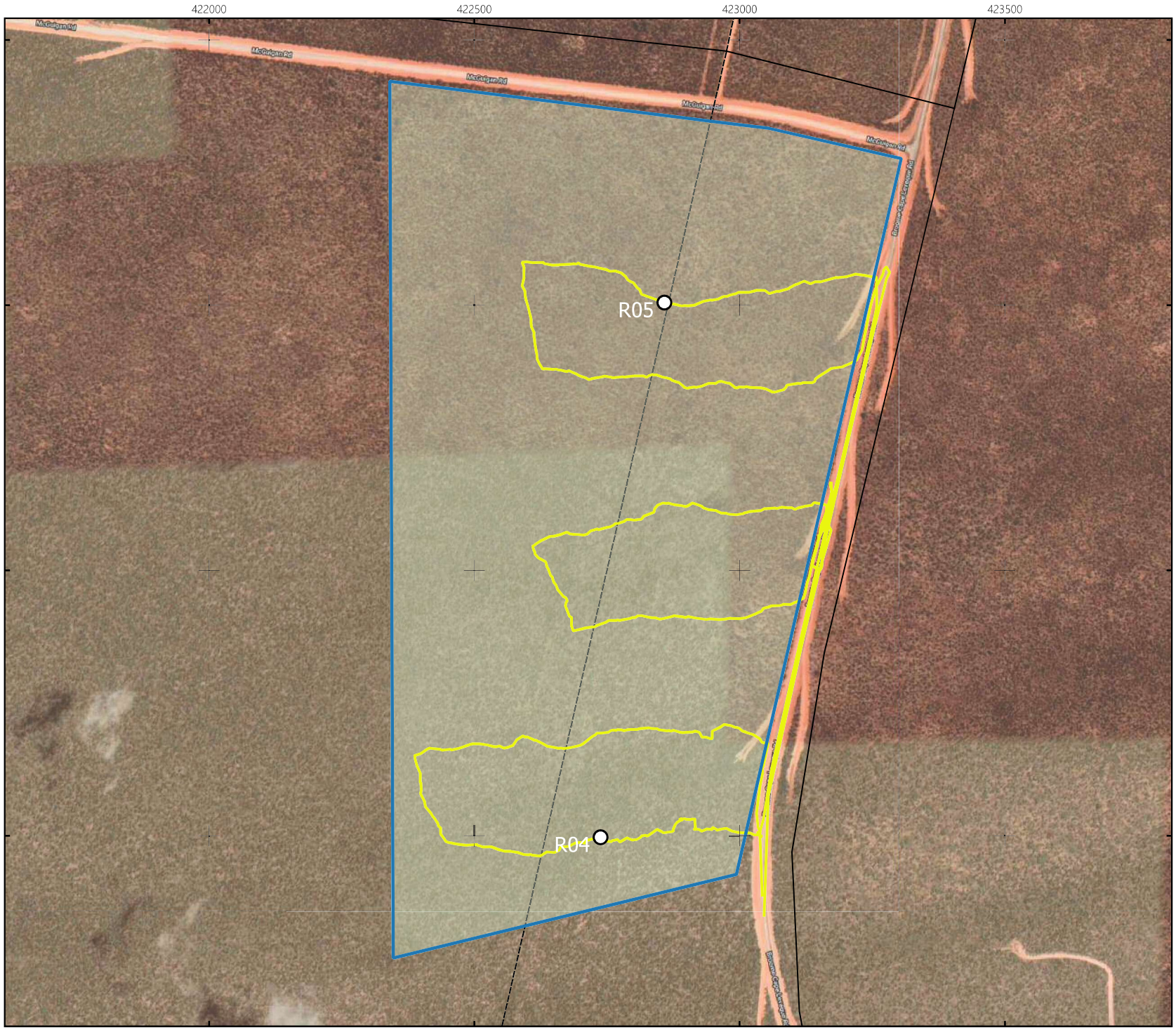
Author: CF Approved: DC Date: 15-01-2020

Vegetation Types Mapped at the D2 Study Area

Proposed Waste Facility

Map 3.4

Prepared for
Shire of Broome | Talis

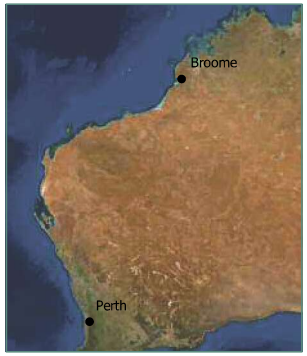


Legend

- Site D2
- Excellent Condition
- Releve Site Locations
- Transects Walked During the Survey

Roads

- Principal Road
- Minor Road
- Track



0 0.1 0.2 0.3 km

Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

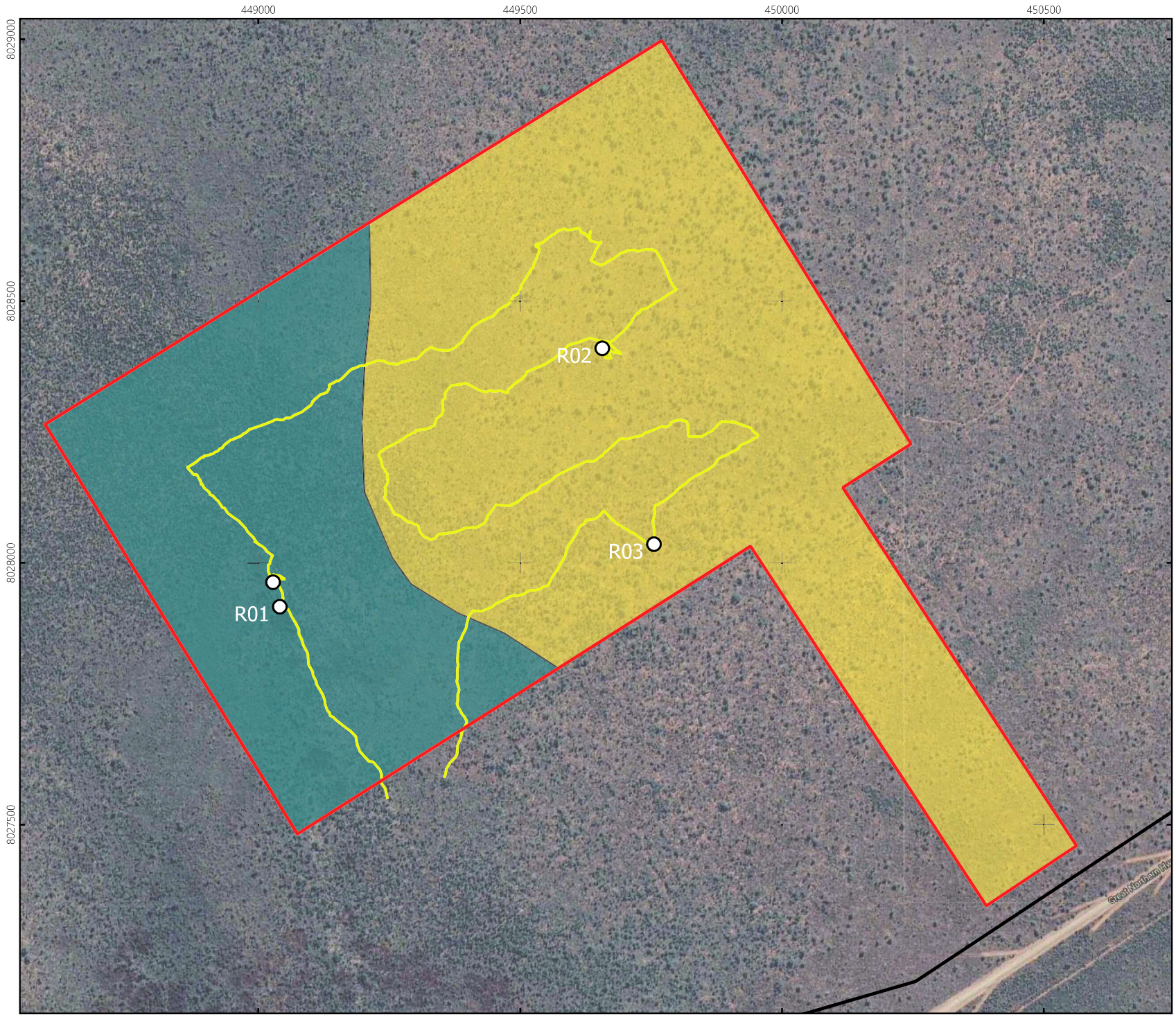
Author: CF Approved: DC Date: 15-01-2020

Vegetation Condition Mapped at the D2 Study Area

Proposed Waste Facility

Map 3.5

Prepared for
Shire of Broome | Talis



Legend

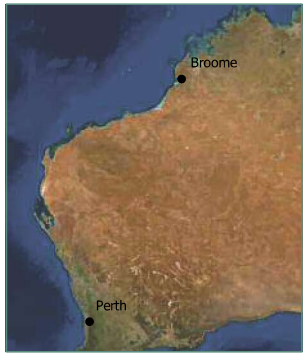
- Site G1
- Releve Site Locations
- Transects Walked During the Survey

Vegetation Types

- 1: C. greeniana over Acacia open shrubland
- 2: Bauhinia open woodland over Acacia shrubland
- 3: C. flavescens and C. greeniana open woodland

Roads

- Principal Road
- Minor Road
- Track



0 0.1 0.2 0.3 km

Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

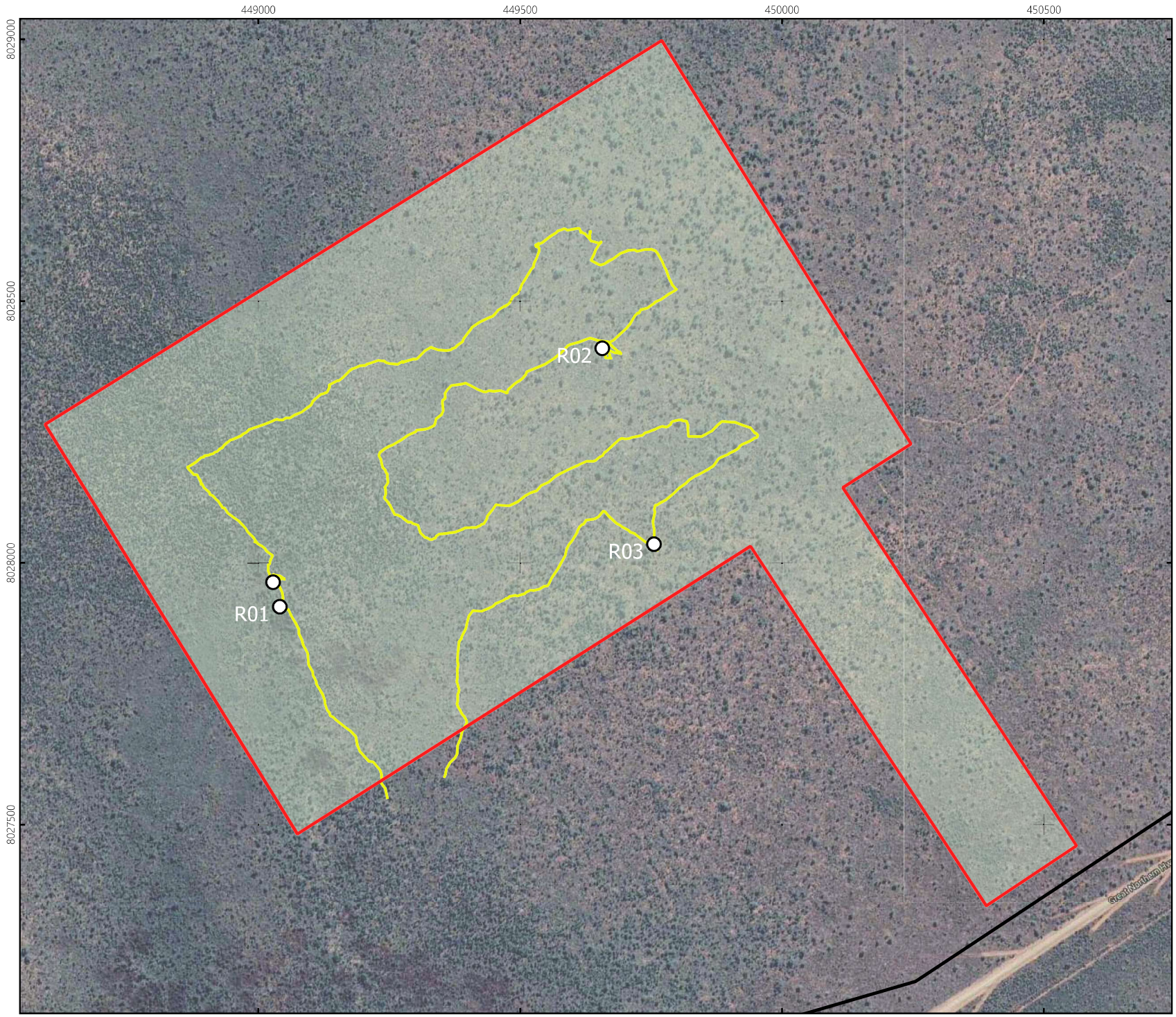
Author: CF Approved: DC Date: 15-01-2020

Vegetation Types Mapped at the G1 Study Area

Proposed Waste Facility

Map 3.6

Prepared for
Shire of Broome | Talis

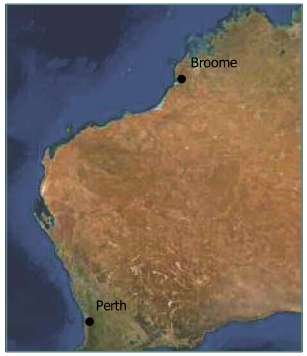


Legend

- Site G1
- Excellent Condition
- Releve Site Locations
- Transects Walked During the Survey

Roads

- Principal Road
- Minor Road
- Track



0 0.1 0.2 0.3 km

Scale 1:10000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CF Approved: DC Date: 15-01-2020

Vegetation Condition Mapped at the G1 Study Area

Proposed Waste Facility

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Map
3.7

3.5. Terrestrial Fauna

3.5.1. Fauna Habitats

Both study areas are dominated by Pindan Shrubland habitats which consist of open to sparse *Acacia* sp. shrubland over tussock grassland, which is mostly homogenous with a natural patchiness in tree, shrub and grass density. Pindan Shrubland habitat was relatively consistent across both study areas and the surrounding region. The fire age across the study area varied from recently burnt to approximately five years. The habitat is characterised by a low-density of *Corymbia* spp. and *Bauhenia cunninghamii* trees, over medium to high density *Acacia eriopoda* and *A. platycarpa* shrubland. The grass layer is typically low to high density *Sorghum plumosom* and *Chrysopogon fallax* on a flat plain of orange sandy clay (Figure 3.1). Leaf litter and wood litter is generally sparse and accumulate only under trees.

Figure 3.1: Typical Habitat Recorded from the Study Areas

3.5.2. Vertebrate Fauna

The literature review and database search identified 53 mammal, 165 bird, 81 reptile and 15 amphibian species that could occur in the region surrounding the study areas. Both study areas do not include any marine or wetland habitats and all species that utilise these habitat types have been excluded from the assessment. Due to the small size of each study area, only a small fraction of the identified species would utilise the study area on an ongoing basis, although all species could potentially occur at some point in time.

3.5.3. Conservation Significant Fauna

Results of the literature review identified 32 conservation significant fauna species (12 mammal, 15 bird and 5 reptile species). An additional 61 conservation significant bird species and two mammal species that are associated with marine, shoreline and wetland environments were also identified however due to the location of the survey areas and a lack of water bodies associated with both survey areas, these species have been excluded from the assessment. The remaining fauna species that were reported in the DBCA Threatened Fauna Database Search are shown in Map 3.8.

The Greater Bilby (*Macrotis lagotis*) is considered to have a high likelihood of occurrence within both the D2 and G1 Study Areas due to the high number of recent records in the surrounding region and the suitability of the habitat present. The nomadic nature of this species means that it can move into areas quickly in response to resource availability. The Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*) is considered to have a medium likelihood of occurrence as it is commonly recorded in the Broome township and it is known to utilise the Pindan Shrubland habitats surrounding the town. Both the Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*) and Northern Coastal Free-tailed Bat (*Mormopterus (Ozimops) cobourgianus*) are considered to have a medium likelihood of occurrence due to previous records and habitats present in the study areas however they are expected to mostly utilise habitats within the D2 Study Area for foraging. The Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) is typically only recorded south of the Great Northern Hwy, however potentially suitable scats have recently been recorded by Yawuru country managers near the D2 Study Area and the habitats within the Study Areas is considered to be suitable for this species.

Of the 15 conservation significant bird species identified, six species are considered to have a medium likelihood of occurrence. The Gouldian Finch (*Erythrura gouldiae*) has historically been recorded from the region although they are typically only recorded from the northern half of the Dampier Peninsula. They are considered to have a medium likelihood of occurrence due to the suitable foraging habitat that occurs in the survey area and the Gouldian Finches ability to move significant distances to utilise food resources as they develop in response to rainfall events. The Oriental Cuckoo (*Cuculus optatus*), Barn Swallow (*Hirundo rustica*) and Fork-tailed Swift (*Apus pacificus*) are migrant species that have been recorded on several occasions around Broome, however their use of the survey area would be infrequent and only for foraging. The Grey Falcon (*Falco hypoleucos*) and Peregrine Falcon (*Falco peregrinus*) have also been recorded from the region surrounding the survey area, however their use of the habitats within this area would be limited to hunting prey bird species.

The Dampierland Goanna (*Varanus sparnus*) is the only conservation significant reptile species that is considered to potentially occur in the survey area. A medium likelihood was given due to the presence of suitable habitat (pindan shrubland) and several records from the surrounding region. This species has only been recently described and exact habitat requirements are currently not well understood.

Table 3.4: Conservation Significant Fauna Species Potentially Occurring at the Study Area

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC	BC	DBCA			
Mammals						
Northern Quoll *Dasyurus hallucatus*	EN	EN	-	Dissected rocky escarpments, gorges and granite boulder piles with access to surface water. Also utilise surrounding eucalypt forest/woodland and drainage lines.	NatureMap (one record in Broome)	Low Only one record and no suitable habitat exists in the study areas.
Kimberley Brush-tailed Phascogale *Phascogale tapoatafa kimberleyensis*	VU	VU	-	Tall open forest/woodland dominated by *Eucalyptus* and *Corymbia* spp. with suitable tree hollows. Typically drier habitats and not rainforest.	NatureMap (one historical record 30km south)	Low Only one historical record although habitat in the study areas could be considered suitable.
Greater Bilby *Macrotis lagotis*	VU	VU	-	Variety of habitats with suitable soil substrates and availability of food resource plants species. Habitats can include hummock grassland, acacia shrubland, open woodland and cracking clays.	High number of Greater Bilby records from, NatureMap, DBCA and several other surveys in the region.	High Commonly recorded across the region with recent records from adjacent to the study areas.
Golden Bandicoot *Isoodon auratus auratus*	VU	VU		Margins of rainforests lined with sandstone in the Northern Kimberley. Eucalypt woodlands in the Yampi Peninsula. Recorded from spinifex and tussock grasslands in arid deserts, as well as tropical forests and woodlands in semi-arid areas.	One historical (written) record from Broome, accuracy 50 km, NatureMap	Low Only one historic record within 40km, other records on the Dampier Peninsular occur over 50 km from Broome.
Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus*	VU	-	P3	Distribution appears to be coastal. Lowland areas, typically in a range of woodland, forest and open environments. One recent record from Pinnacle Creek in the central Kimberley.	One historic (1982) record form NatureMap and PMST, potential habitat may be present within the area	Medium Historic record 25 km north of D2 Study Area. Has been recorded from pindan habitat on the Dampier Peninsula previously (McKenzie *et. al.* 2018).
Northern Brushtail Possum *Trichosurus vulpecula arnhemensis*	-	VU	-	Dry forest/woodland dominated by *Eucalyptus* and *Corymbia* spp. with suitably large trees, hollows and developed understory. Low fire frequency is often associated with suitable habitat.	NatureMap, DBCA (numerous records in Broome and inland), and it has been recorded on one other survey in the region (Western Wildlife; Duchess Paradise 2011).	Medium Several records nearby and suitable habitat occurs within the study areas.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC	BC	DBCA			
Northern Coastal Free-tailed Bat *Mormopterus (Ozimops) cobourgianus*	-	-	P1	Western Australian populations are associated with mangrove communities with roosts only recorded from *Avicennia marina*, however Northern Territory populations also utilise woodland habitats.	DBCA (one record in 2016, within the D2 study area).	**Medium** One record within the D2 Study area although no suitable mangrove habitat present within either study area, May utilise woodland habitats.
Yellow-lipped Cave Bat *Vespadelus douglasorum*	-	-	P2	Tropical woodlands, often along streams lined with Melaleuca and Pandanus. Utilises sandstone and limestone caves, usually near water.	Beagle Bay survey (ecologia 2005)	**Low** Nearest records over 100km north, no suitable habitat in the study areas
Spectacled Hare-wallaby *Lagorchestes conspicillatus leichardti*	-	-	P4	Inhabits grasslands, open forests, open woodlands and tall shrublands and shelters during the day under grass tussocks. Long unburnt areas considered most suitable.	NatureMap (many records further inland), Potential scats recorded from a recent survey in the region.	**Medium** Previously recorded from the region to the east and south-east. Suitable habitat occurs in both Study Areas.
Scaly-tailed Possum *Wyulda squamicaudata*	-	-	P4	Structurally complex, rocky landscapes with deep crevices for shelter and open woodland, closed forest and rainforest pockets which supply a variety of fruiting trees.	NatureMap (one record from 1970 in Broome)	**Low** Only one historical record within 40km, distribution typically restricted north of the Dampier. No suitable habitat.
Short-tailed Mouse *Leggadina lakedownensis*	-	-	P4	Acacia shrubland, samphire, woodlands, and stony ranges. Also Spinifex and tussock grassland on cracking clays in the Pilbara region.	Thunderbird (ecologia 2016b), Duchess Paradise (Western Wildlife 2011)	**Low** Although suitable habitat exists within the study area, the nearest records are over 80km away
Golden-backed Tree-rat *Mesembriomys macrurus*	-	-	P4	Recorded from a variety of habitats including Eucalypt open forests with tussock grass understorey, rainforest patches on a variety of landforms and soils, eucalypt woodlands with hummock grass understorey, rugged sandstone screes, beaches, and blacksoil plains with pandanus.	One historical (written) record from Broome, accuracy 50 km (DBCA), NatureMap	**Low** Only one historic record within 40km, No other records on the Dampier Peninsular. Current distribution typically restricted to north and east of Derby.
Birds						
Gouldian Finch *Erythrura gouldiae*	EN	-	P4	Wooded rocky hills with adjoining flat country. Key habitat attribute is annual spear grasses or perennial sorghum in the understorey during the dry season.	PMST, NatureMap	**Medium** Two historical records in the area (1973), suitable habitat occurs in the Study Areas.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC	BC	DBCA			
Red Goshawk *Erythrotriorchis radiatus*	VU	VU	-	Coastal and sub-coastal areas in wooded/forested lands and riverine forests of tropical and warm-temperate Australia. Vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins.	PMST, NatureMap	Low One historic record from Broome, distribution typically restricted to north of the Dampier Peninsula.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	Sand dunes and sand flats in the arid zone with open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus*, *Casuarina* or *Allocasuarina* trees; an understorey of shrubs such as *Acacia* (especially *A. aneura*), *Cassia*, *Eremophila*, *Grevillea*, *Hakea* and *Senna*; and a ground cover dominated by *Triodia* species. Also riverine or littoral areas	PMST, NatureMap	Low One 20-year-old record from Broome, no suitable habitat in the study areas
Masked Owl (Northern) *Tyto novaehollandiae kimberli*	VU	-	P1	Riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves. Require tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging as they remain in territory all year.	PMST, NatureMap	Low No records of this subspecies exist on the Dampier Peninsula. No suitable habitat in the Study Areas.
Oriental Pratincole *Glareola maldivarum*	IA	IA	-	Typically utilise inland ephemeral wetland habitat types when present. Can also be found foraging in adjacent open grassland habitats	PMST, NatureMap	Low Multiple records along Roebuck Plains, no suitable habitat present within Study Areas
Oriental Cuckoo *Cuculus optatus*	IA	IA	-	Mixture of forest and woodland habitats across Eurasia.	PMST, NatureMap	Medium Several records nearby and suitable habitat occurs within the Study Areas
Red-rumped Swallow *Cecropis daurica*	IA	IA	-	Vagrant species occurs across Europe, Africa and Asia. Typical swallow behavior hawking insects over a variety of habitats.	PMST, NatureMap	Low This vagrant is only rarely recorded in northern WA
Barn Swallow *Hirundo rustica*	IA	IA	-	Open country in coastal lowlands, often near freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland. Also recorded from urban areas perched on overhead wires.	PMST, DBCA (19 records), NatureMap	Medium Many records within 40km and suitable habitat occurs within the study area

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC	BC	DBCA			
Fork-tailed Swift *Apus pacificus*	IA	IA	-	Nomadic, almost entirely aerial lifestyle over a variety of habitats; associated with storm fronts.	PMST, DBCA (19 records), NatureMap	**Medium** Many records within 40km and suitable habitat occurs within the study area, however almost entirely aerial lifestyle
White-throated Needletail *Hirundapus caudacutus*	IA	IA		Nomadic, almost entirely aerial lifestyle over a variety of habitats; although most often over wooded areas and shrublands.	One record from Broome Bird Observatory (2000) NatureMap	**Low** Vagrant. Few records from the region.
Grey Wagtail *Motacilla cinerea*	IA	IA	-	Occurs across Eurasia in a variety of habitats associated with moving water (rivers, streams). Some individuals migrate as far south as northern Australia.	PMST, NatureMap (recent records from northern edge of Roebuck Plain)	**Low** Vagrant. Few records from Roebuck Plain, no suitable habitat present within study area
Yellow Wagtail *Motacilla flava*	IA	IA	-	Occurs across Europe, Western Asia and Africa. Occurs across a variety of damp or wet habitats with low vegetation, such as damp meadows, marshes, waterside pastures etc.	PMST, NatureMap (one record from Broome).	**Low** Vagrant. One record from Broome, no suitable habitat present
Grey Falcon *Falco hypoleucos*	-	VU	-	Generally open inland plains and woodland habitats.	NatureMap	**Medium** Several records nearby and suitable habitat occurs within the study area
Peregrine Falcon *Falco peregrinus*	-	OS	-	Widespread; coastal cliffs, riverine gorges and wooded watercourses.	DBCA (four records), NatureMap	**Medium** Many records within 40km and suitable habitat occurs within the study area
Letter-winged Kite *Elanus scriptus*	-	-	P4	Open country and grasslands in arid and semi-arid Australia, where there are tree-lined streams or water courses.	NatureMap	**Low** Two older records from 1994 from Broome, species recorded sporadically along the coast

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC	BC	DBCA			
Reptiles						
Great Desert Skink *Liopholis kintorei*	VU	VU		Generally associated with red sandplains and sand ridges. In WA also associated with *Triodia basedowii* and *T. schinzii* with some *Eremophila leucophylla* shrubs. Also gravelly undulating plain with scattered Black Gidgee (*Acacia pruinocarpa*) or Mulga over *Triodia basedowii* and low shrubs.	One historical (written) record from Great Sandy Desert, NatureMap	Low Only one historic record within 40km. Current distribution typically restricted to Central Desert regions
Dampierland Goanna *Varanus sparnus*	-	-	P1	Recently described species, with current records from Pindan Shrubland habitats located across the Dampier Peninsula.	NatureMap, a few recent surveys on the Dampier Peninsula have recorded this species.	Medium Previous records nearby and suitable habitat occurs within the study area.
Dampierland Plain Slider *Lerista separanda*	-	-	P2	Recorded from coastal dunes and inland sand dunes south to the northern Pilbara.	NatureMap (records from Broome)	Low Coastal species which is very rarely inland of Broome.
Dampierland Burrowing Snake *Simoselaps minimus*	-	-	P2	Limited habitat information available. Previously recorded from coastal dunes on the Dampier Peninsula.	NatureMap, one record from Broome and northern coast	Low Records are from along the coast and no suitable habitat present within the study area
Northwestern Coastal Ctenotus *Ctenotus angusticeps*	-	-	P3	Landward fringe of salt marsh communities in samphire shrubland or marine couch grassland (Maryan et al. 2013) in the intertidal zone along mangrove margins.	DBCA (nine recent records in dunes/mangrove areas), NatureMap	Low Records from the coast, no suitable habitat within the study area

Legend

WAM Arachnida

- Aname `MYG231?`
- Aname `MYG284`
- Aname `MYG388`
- Beierolpium `sp. indet. (juvenile 3/1) small`
- Conothele `MYG543`
- Conothele `MYG613`
- Conothele `MYG614`
- Conothele `MYG615`
- Conothele `MYG616`
- Conothele `MYG617`
- Isometrus maculatus
- Kwonkan `MYG285`
- Lychas `JPP`
- Synothele `MYG179`
- Urodacus `fossor?`
- Urodacus `kraepelini`

WAM Crustacea

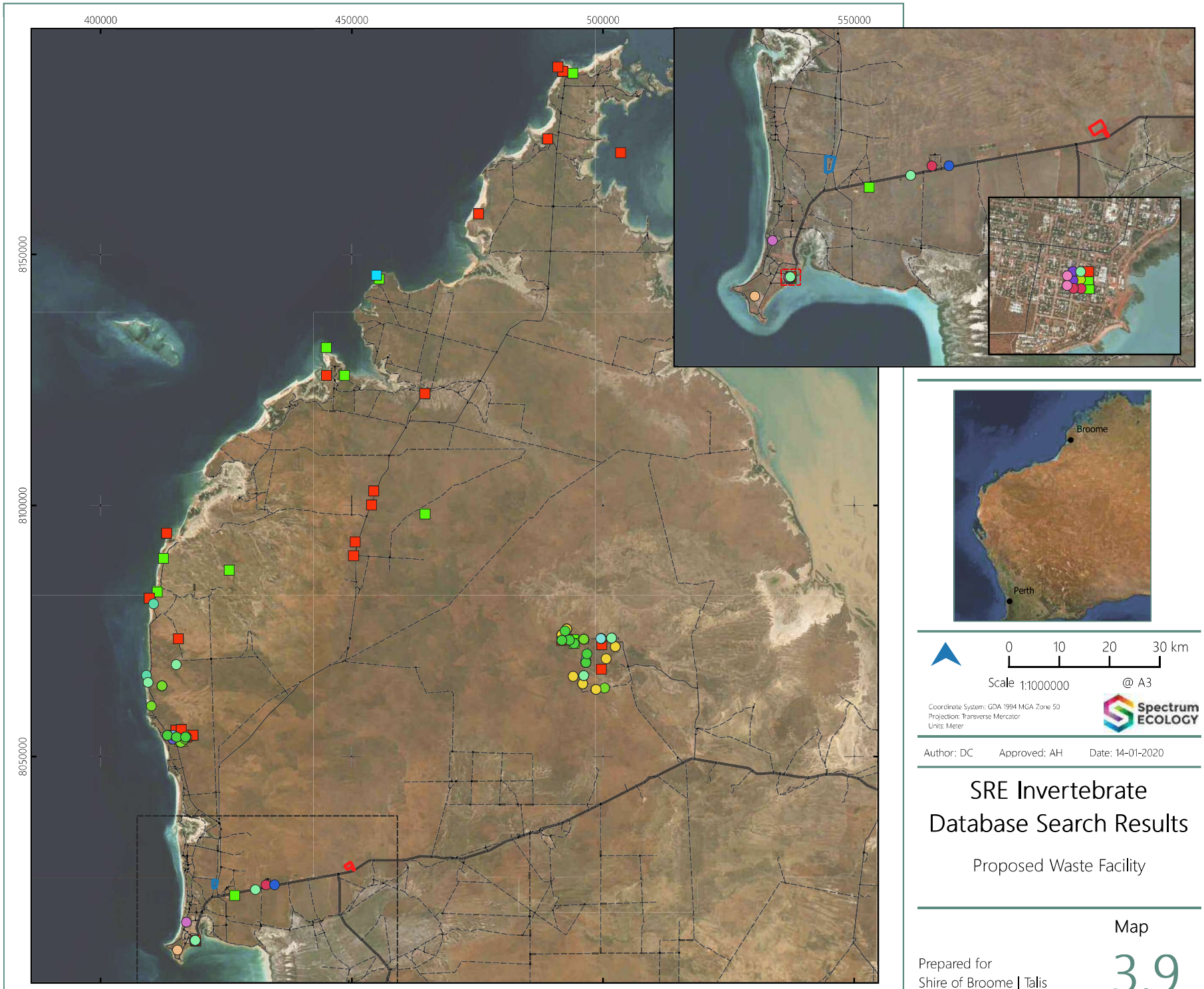
- Buddelundia 'sp.43'

WAM Mollusca

- Quistrachia leptogramma
- Rhagada bulgana
- Rhagada cf. bulgana
- Site D2
- Site G1

Roads

- Principal Road
- Minor Road
- Track



0 10 20 30 km

Scale 1:1000000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: DC Approved: AH Date: 14-01-2020

SRE Invertebrate Database Search Results

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Map
3.9

3.5.4. Short Range Endemic Invertebrates

The WA Museum SRE invertebrate database search identified 16 taxa of Arachnida; consisting of four wishbone spiders (Anamidae), one brushed trapdoor spider (Barychelidae), six mygalomorph spiders from the *Conothele* genus (Halonoproctidae), one pseudoscorpion (Olpiidae) and two scorpions each from the Buthidae and Urodacidae families. The majority of the taxa identified have been recorded from projects located across the Dampier Peninsula indicating that suitable habitats could extend across the region. Five *Conothele* taxa were recorded only from the Broome townsite with the only habitat identified being remnant rainforest with two of the individuals being recorded from within urban dwellings. One record of *Urodacus* `fossor?` was identified from the Great Northern Hwy in Pindan Shrubland habitat with six records of the very closely related *Urodacus* `kraepelini` identified from similar habitat across the Dampier Peninsula.

Only one Crustracea taxa was identified belonging to the isopod family Armadillidae. Three records of *Buddelundia* '43' were identified from the James Price Point region.

The search of the Mollusca database identified two snail species from the Camaenidae family. Both *Quistrachia leptogramma* and *Rhagada bulgana* have been recorded across the Dampier Peninsula in woodland and shrubland habitats.

A summary of the results of the database searches and an assessment on potential impacts to each taxa based on the proposed vegetation clearing are provided in Table 3.5 and the locations mapped in Map 3.9.

Table 3.5: WA Museum Invertebrate Database Search Results

Species	Previous Records	Likelihood of Occurrence	Potential for Significant Impact
Arachnida			
Anamidae			
Aname `MYG231?`	Three records from James Price Point region. All records located along the coast in dense coastal vegetation.	Low Dense coastal habitats were not recorded from the Study Areas.	Low Population has only been recorded around the James Price Point area. Habitats within the Study Areas extend across the Dampier Peninsula.
Aname `MYG284`	29 records from James Price Point (11) and the Sheffield Resources Thunderbird project (18). Locations occur over 80 km apart, with individuals from James Price Point located within 5 km of the coast and Thunderbird individuals associated with the Fraser River Drainage system. Habitat described as Pindan Shrubland.	Medium Nearest record located 28 km north of the D2 Study Area. Micro habitats in the Study Areas expected to be similar to those found in the James price Point and Thunderbird projects.	Low Populations appear to extend into the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Aname `MYG388`	5 records from James Price Point (1) and the Sheffield Resources Thunderbird project (4). Locations occur over 80 km apart, with individuals from James Price Point located within 2 km of the coast and Thunderbird individuals associated with the Fraser River Drainage system.	Medium Nearest record located 29 km north of the D2 Study Area. Micro habitats in the Study Areas could be similar to those found in the James price Point and Thunderbird projects.	Low Populations appear to extend into the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Kwonkan `MYG285`	17 records from James Price Point (1) and the Sheffield Resources Thunderbird project (16). Locations occur over 80 km apart, with individuals from James Price Point located within 5 km of the coast and Thunderbird individuals associated with the Fraser River Drainage system. Habitat described as Pindan Shrubland.	Medium Nearest record located 29 km north of the D2 Study Area. Micro habitats in the Study Areas expected to be similar to those found in the James price Point and Thunderbird projects.	Low Populations appear to extend into the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Barychelidae			
Synothele `MYG179`	One record from James Price Point region and located along the coast in a small patch of dense vegetation located within 2 km of the coast.	Low Dense coastal habitats were not recorded from the Study Areas.	Low Population has only been recorded around the James Price Point area. Habitats within the Study Areas extend across the Dampier Peninsula.
Halonoproctidae			
Conothele `MYG543`	One record from James Price Point region and located along the coast in a small patch of dense vegetation located within 2 km of the coast.	Low Dense coastal habitats were not recorded from the Study Areas.	Low Population has only been recorded around the James Price Point area. Habitats within the Study Areas extend across the Dampier Peninsula.

Species	Previous Records	Likelihood of Occurrence	Potential for Significant Impact
Conothele `MYG613`	One record from within the Broome town site. No habitat description available.	Medium Habitat unknown however within 10 km of the D2 Study Area.	Low Only one record from within Broome. Habitats within the Study Areas extend across the Dampier Peninsula.
Conothele `MYG614`	One record from within the Broome town site in remnant rainforest habitat.	Low Remnant rainforest habitat were not recorded from the Study Areas.	Low Only one record from within Broome. Habitats within the Study Areas do not match the available habitat requirements for this taxa.
Conothele `MYG615`	One record from within the Broome town site; recorded from within a house.	Medium Habitat unknown however within 10 km of the D2 Study Area.	Low Only one record from within Broome. Suitable habitat unknown although able to survive in urban areas. Habitats within the Study Areas extend across the Dampier Peninsula.
Conothele `MYG616`	Three records from within the Broome town site; recorded from within a house.	Medium Habitat unknown however within 10 km of the D2 Study Area.	Low Only recorded from within Broome. Suitable habitat unknown although able to survive in urban areas. Habitats within the Study Areas extend across the Dampier Peninsula.
Conothele `MYG617`	One record from within the Broome town site. No habitat description available.	Medium Habitat unknown however within 10 km of the D2 Study Area.	Low Only one record from within Broome. Suitable habitat unknown. Habitats within the Study Areas extend across the Dampier Peninsula.
Olpiidae			
Beierolpium `sp. indet. (juvenile 3/1) small`	One record from James Price Point region and located along the coast in a small patch of dense vegetation located within 2 km of the coast.	Low Dense coastal habitats were not recorded from the Study Areas.	Low Population has only been recorded around the James Price Point area. Habitats within the Study Areas extend across the Dampier Peninsula.
Buthidae			
Lesser Brown Scorpion *Isometrus maculatus*	Two records from within the Broome town site. No habitat description available.	Medium Habitat unknown however within 10 km of the D2 Study Area.	Not considered an SRE Recorded from across the Australia and into Papua New Guinea. Not considered an SRE.

Species	Previous Records	Likelihood of Occurrence	Potential for Significant Impact
Lychas `JPP`	21 records from James Price Point (9) and the Sheffield Resources Thunderbird project (12). Locations occur over 80 km apart, with individuals from James Price Point located within 5 km of the coast and Thunderbird individuals associated with the Fraser River Drainage system.	Medium Nearest record located 29 km north of the D2 Study Area. Micro habitats in the Study Areas could be similar to those found in the James price Point and Thunderbird projects.	Low Populations appear to extend into the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Urodacidae			
Urodacus `fossor?`	One record from Great Northern Hwy approximately 11 km west of D2 (14 km east of G1). No habitat description available.	High Micro habitats in the Study Areas are expected to be similar to those found near the location of the record.	Low Recorded in proximity to the Study Areas however the Pindan Shrubland habitat occurs extensively across the region and the population is expected to be similarly distributed.
Urodacus `kraepelini`	Six records from across the Dampier Peninsula including one from Broome (Liquorama Store) and one from approximately 8 km east of D2 (18 km west of G1). Habitat described as Pindan Shrubland and Open Woodland.	High Micro habitats in the Study Areas are expected to be similar to those found near the location of the record.	Low Populations appear to extend into the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Crustacea			
Armadillidae			
Buddelundia '43'	Three records from James Price Point region. All records located along the coast in dense coastal vegetation.	Low Dense coastal habitats were not recorded from the Study Areas.	Low Population has only been recorded around the James Price Point area. Habitats within the Study Areas extend across the Dampier Peninsula.
Mollusca			
Camaenidae			
Quistrachia leptogramma	25 records from across the Dampier Peninsula including one from 4 km east southeast of D2. Available habitats described include leaf litter under Ironwood trees (*Erythrophleum chlorostachys*).	High Micro habitats in the Study Areas are expected to be similar to those found near the location of the record.	Low Populations appear to occur across the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.
Rhagada bulgana	33 records from across the Dampier Peninsula including one from Broome, 11 km south southwest of D2. Available habitats described include Eucalypt Woodland and also leaf litter under Ironwood trees (*Erythrophleum chlorostachys*).	High Micro habitats in the Study Areas are expected to be similar to those found near the location of the record.	Low Populations appear to occur across the Dampier Peninsula and habitats associated with these areas are extensively distributed outside of the Study Areas.

Legend

- Site D2
- Site G

DBCA Threatened Fauna Database

- VU
- IA
- OS
- P1
- P3
- P4

Roads

- Dual Carriageway
- Minor Road
- Principal Road
- Secondary Road
- Track

N

0 1 2 3 4 5 km

Scale 1:250000 @ A4

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: AH Approved: DC Date: 15-01-2020

DBCA Fauna Database Search Results

Proposed Waste Facility

MAP 3.8

Prepared for
Shire of Broome | Talis

4. DISCUSSION

4.1. Flora

4.1.1. D2 Study Area

4.1.1.1. Threatened and Priority Flora

No Threatened or Priority Flora were recorded from the D2 Study Area during the survey.

One Threatened Flora species, *Seringia exastia* was returned in the database searches and has a Medium Likelihood of Occurrence for the study areas. Some associated species are present, however suitable geological habitat of relict dune systems is not present in the D2 Study Area.

One Priority One species, *Corymbia paractia* is classified as Recorded adjacent to the D2 Study Area as it is known to occur on the boundary of the Study Area, from the Database search results and Literature Review (see Appendix A). The Environs Kimberley targeted flora survey (2018) recorded populations of this species from within the road reserves directly north and east of the D2 Study Area. The D2 Study Area holds suitable habitat for *C. paractia*.

Species distribution mapping (Environs Kimberley 2018), indicated that populations of *C. paractia* potentially occur within the D2 Study Area, with the highest probability of occurrence located adjacent to the west. As discussed in Section 3.3.1, reproductive floristic material is needed to conclusively identify this species. Additional survey effort during more favourable seasonal conditions may aid in confirming this species' presence or absence.

There are five species classified with High Likelihood of occurrence within the study areas (see Appendix A). All have suitable habitat occurring in the D2 Study Area and have known records in the vicinity (within 20 km) of the D2 Study Area. They are discussed in Table 4.1.

Table 4.1: Priority Flora with High Likelihood in the Vicinity of the D2 Study Area

Species (Conservation Significance)	Growth Habit	Known Records within 20 km of the D2 Study Area
Jacquemontia sp. Broome (P1)	Prostrate perennial herb Fl: Mar-May	• Seven WA Herbarium records • Flora, Vegetation and Fauna Assessment – Broome Asparagus Farm (AECOM 2017) • Broome Landfill Flora, Vegetation and Fauna Survey (ASTRON 2017) • Broome Motorplex Environmental Site Investigation (GHD 2016) • Broome Road Industrial Area Targeted Survey (GHD 2018)
Glycine pindanica (P3)	Prostrate perennial herb or climber Fl: Feb/Mar-Jun	• 17 WA Herbarium records • Five TPFL records
Polymeria sp. Broome (P3)	Annual herb Fl: Mar-May	• Four WA Herbarium records • Broome Motorplex Environmental Site Investigation (GHD 2016) • Broome Road Industrial Area Targeted Survey (GHD 2018)
Seringia katatona (P3)	Shrub Fl: Mar-Apr	• Three WA Herbarium records

Species (Conservation Significance)	Growth Habit	Known Records within 20 km of the D2 Study Area
Terminalia kumpaja (P3)	Tree Fl: Oct-Jan Fr: Jun-Aug	• Five WA Herbarium records • Broome Motorplex Environmental Site Investigation (GHD 2016)

Three of these species are herbs, seasonal in growth habit; *Jacquemontia* sp. Broome (P1), *Glycine pindanica* (P3) and *Polymeria* sp. Broome (P3). Confirmation of presence for these species would have been difficult during this survey given the poor seasonal conditions (see Section 1.4).

Populations of three Priority flora taxa, *Jacquemontia* sp. Broome (P1), *Polymeria* sp. Broome (P3) and *Terminalia kumpaja* (P3) were identified in the immediate vicinity of the D2 Study Area (within 2 km), from four studies in the Literature Review (see Table 4.1, Map 3.2 and, for locations of the survey areas, Map 1.3). Each of these surveys were conducted during the months immediately following the wet season; March to May (see Table 1.5) further illustrating the presence of these perennial herbs during optimal survey timing, post wet season.

While some of the Priority Flora discussed in Table 4.1 are detectable throughout the year and would have been identified in the Study Area if present; survey timing and poor seasonal conditions prevented the detection of the herbs; *Jacquemontia* sp. Broome (P1) and *Polymeria* sp. Broome (P3). Poor seasonal conditions also inhibited the conformation of the presence of *Corymbia paractia* (P1) due to the lack of flowering material; despite optimal survey timing. To effectively assess the of presence/absence of these three species at the D2 Study Area, surveying during improved seasonal conditions would ensure the detectability of these species.

One other Priority Flora species, *Aphyllodium parvifolium* (P1), was recorded in the vicinity (20 km) of the D2 Study Area. This has a Medium Likelihood of occurrence. Suitable habitat for this Priority taxa is not present in the D2 Study Area.

4.1.1.2. Local and Regional Significance

The distribution of *Corymbia paractia* (P1) is endemic to the Broome Peninsula occurring throughout and directly to the west of the D2 Study Area (Environs Kimberley, 2018). Although this study did not record *C. paractia*, it is highly likely that surveying in more favourable seasonal conditions will return the presence of this species. Given the small range of this species, any impact to the populations *C. paractia* in this area holds high local and regional significance. Further definition of this population would be favourable.

Three Priority Flora, *Jacquemontia* sp. Broome (P1), *Glycine pindanica* (P3) and *Polymeria* sp. Broome (P3), are known from few records and are possibly restricted in range. Populations of these taxa hold high local and regional significance. Presence/absence of these Priority Flora should be confirmed prior to clearing. If present, impact should be avoided where possible.

The remaining two Priority Flora of High Likelihood, *Seringia katatona* (P3) and *Terminalia kumpaja* (P3), are known from more records and have a greater distribution north and south of the Dampier Peninsula. Populations of these Priority Flora hold moderate local and regional significance. Presence/absence of these Priority Flora should be confirmed prior to clearing. If present, impact should be avoided where possible.

4.1.2. G1 Study Area

4.1.2.1. Threatened and Priority Flora

No Threatened or Priority Flora were recorded from the G1 Study Area during the survey.

One Threatened Flora species, *Seringia exastia* was returned in the database searches and has a Medium Likelihood of Occurrence for the study areas. Some known associated species are present within the Study Area; however, suitable geological habitat of relict dune systems is not present in the G1 Study Area.

One Priority One species, *Corymbia paractia* is classified as Recorded from the Database search results (see Section 3.1 and Appendix A). The G1 Study Area potentially holds suitable habitat for *C. paractia*. Species distribution mapping from the Environs Kimberley targeted search (Environs Kimberley, 2018), indicated that the G1 Study Area is too far east and inland of the species' known distribution. As such, *C. paractia* has a low likelihood of occurance within the G1 study area.

Of the five species classified with High Likelihood to occur within the study areas (see Appendix A), all have suitable habitat occurring in the G1 Study Area and two are within the vicinity (20 km) of the G1 Study Area. These are discussed in Table 4.2.

Table 4.2: Priority Flora with High Likelihood in the Vicinity of the G1 Study Area

Species (Conservation Significance)	Growth Habit	Known Records within 20 km of the G1 Study Area
Jacquemontia sp. Broome (P1)	Prostrate perennial herb Fl: Mar-May	• Flora, Vegetation and Fauna Assessment – Broome Asparagus Farm (AECOM 2017)
Polymeria sp. Broome (P3)	Annual herb Fl: Mar-May	• Four WA Herbarium records • Broome Motorplex Environmental Site Investigation (GHD 2016) (exact location of survey area unknown, assumed in close proximity to the study areas) • Broome Road Industrial Area Targeted Survey (GHD 2018)

Both *Jacquemontia* sp. Broome (P1) and *Polymeria* sp. Broome (P3), are herbs; seasonal in habit. Confirmation of presence for these species would have been difficult during this survey given the poor seasonal conditions (see Section 1.4). Additional survey effort during more favourable seasonal conditions and during appropriate flowering period (Mar-May) would be required to confirm these species' presence or absence.

Two other Priority Flora are recorded within 20 km of the G1 Study Area. These are:

- *Tetragonia coronata* (P3); 17 km west. Medium Likelihood; and
- *Fuirena incrassata* (P3); 18 m east, Low Likelihood, 2 records.

Suitable habitat for these Priority taxa is not present in the G1 Study Area.

4.1.2.2. Local and Regional Significance

The two Priority Flora in the vicinity of the G1 Study Area, with High Likelihood of occurrence, *Jacquemontia* sp. Broome (P1) and *Polymeria* sp. Broome (P3), are known from few records and are possibly restricted in range. Populations of these taxa hold high local and regional significance. Impact should be avoided where possible.

4.2. Vegetation

4.2.1. D2 Study Area

4.2.1.1. Vegetation Resembling TECs or PECs

Threatened Ecological Communities

No Threatened Ecological Communities were recorded from the D2 Study Area.

Priority Ecological Community; Mangarr (Minyjuru) (17327)

One Priority One Ecological Community was identified during the database searches as intersecting the north-western corner of the D2 Study Area (see Map 3.1). This P1 PEC is Mangarr (Minyjuru) (17327), a relict dune system dominated by extensive stands of Mangarr (Minyjuru) *Sersalisia* formerly (*Pouteria*) *sericea*.

The buffer included on this circular PEC polygon is 500m. It is likely that this PEC surrounds a stand of *Sersalisia sericea* previously recorded from the north-western corner of the D2 Study Area. Given the PEC polygon diameter is 1100-1200m, the population of *Sersalisia sericea* is expected to be spatially constrained. Typically, *Sersalisia sericea* occurs in dune systems closer to the coast, associated with vine thickets, beach forest and monsoon forest. The clearing required for the access tracks and drill pads (25 ha) is unlikely to impact this PEC and associated buffer.

The vegetation and habitat of the D2 Study Area is not typical of the habitat associated with *Sersalisia sericea*. No *S. sericea* was recorded from the current survey. There are 19 records of the Mangarr (Minyjuru) PEC identified within 50 km of the study areas. All of these are small in size (less than 3 km at the widest point) and occur on the peninsula of Broome township. Additional survey effort in the area of D2 within the PEC buffer zone would confirm the presence or absence of this PEC if the area is at risk of being impacted. The 25 ha access tracks and drill pad footprint will also be designed in such a way that this portion of the D2 study area will be avoided.

Communities Considered Significant as Priority Flora Habitat

Habitat for the Priority One Flora *Corymbia paractia* is recorded throughout the D2 Study Area. This species was recorded at the northern and western boundary of this study area during the Environs Kimberley (2018) targeted search for *C. paractia*. Presence of this species at the D2 Study Area and species distribution mapping, indicated that this area has high significance as potential habitat.

PECs in the Vicinity of the D2 Study Area

Conservation significant ecological communities present within 5 km south and west of the D2 Study Area (see Section 3.2) include:

- Roebuck Bay Mudflats; Vulnerable, 1 km south;
- Mangarr (Minyjuru); Priority One; Intersecting, 1.7 km south-east and 3.6 km south-west;
- Kimberley Vegetation Association 770; Priority One, 3.9 km west; and
- Kimberley Vegetation Association 73; Priority Three, 3.2 km west and 3.2 km south.

The above Ecological Communities are riparian and do not resemble the vegetation communities recorded from the D2 Study Area.

4.2.1.2. Local and Regional Significance

The D2 Study Area holds moderate to high local and regional significance for the presence of:

- PEC Mangarr (Minyiuru) (17327); and
- Habitat for the Priority One Flora *Corymbia paractia*.

The PEC Mangarr (Minyjuru) (17327) is considered to have moderate local and regional significance in the D2 Study Area. Given the:

- small size of PEC Mangarr (Minyjuru) (17327) present at the D2 Study Area;
- atypical habitat association with *S. sericea* at the D2 Study Area; and
- small size of other records of the Mangarr (Minyjuru) PEC.

Should the presence of *S. sericea* be confirmed in subsequent surveys of the D2 Study Area, the PEC Mangarr (Minyjuru) (17327) will have greater local and regional significance.

Presence of this species at the D2 Study Area and species distribution mapping, indicated that this area has high local and regional significance as providing habitat for Priority One Flora, *Corymbia paractia*.

4.2.2. G1 Study Area

4.2.2.1. Vegetation Resembling TECs or PECs

There were no vegetation types identified in the current assessment or the desktop assessments resembling PECs or TECs or considered significant due to historical impact from threatening processes, or providing a function to maintain ecological integrity of a significant ecosystem at the G1 Study Area.

The G1 Study Area is located on Pindan Plains which holds potential significance as habitat for Priority One Flora *Corymbia paractica*. Species distribution mapping from the Environs Kimberley targeted search for *C. paractica* in the Broome area (2018), indicated that the G1 Study Area has a low likelihood of providing appropriate habitat for this species to occur.

There are three conservation significant ecological communities present within 10 km south of the G1 Study Area (see Section 3.2). They are:

- Roebuck Bay Mudflats; Vulnerable, 8 km south-west;
- Kimberley Vegetation Association 73; Priority Three, 2.4 km south-east; and
- Roebuck Landsystem; Priority Three, 2.8 km south-east.

All of these Ecological Communities are riparian and do not resemble the vegetation communities recorded from the G1 Study Area.

4.2.2.2. Local and Regional Significance

There were no vegetation types considered to have high local or regional significance in the G1 Study Area.

4.3. Fauna

4.3.1. Fauna Habitats

The fauna habitat types and vertebrate fauna assemblage that was both identified during the literature review and was recorded from the Survey Areas is typical of the wider Dampier Peninsular region and are not considered unique or significant. Extensive areas of similar habitat occur to the north east and further to the south indicating that any vertebrate fauna disturbed by the clearing activities will be able to move away from the site. The proximity to the town of Broome, associated road infrastructure and the presence of feral predator species indicates a moderate level of disturbance that would impact the vertebrate fauna present at the site.

The purpose of the assessment is to determine impacts from clearing of native vegetation to complete preliminary ground disturbance works. The areas to be cleared are considered very small and are relatively widely spaced. The proposed clearing activities are not expected to significantly impact any of the identified conservation significant fauna species that are expected to utilise habitats within the survey area.

4.3.2. Conservation Significant Fauna

The Greater Bilby (*Macrotis lagotis*) is currently listed as Vulnerable under both the *EPBC Act* and the *BC Act*, following the IUCN common assessment method. Although once widespread across arid and semi-arid Australia, the Greater Bilby is now primarily restricted to sandy inland deserts in the north-west of the continent. It can be found in a range of habitats with moderately open ground-level vegetation, from cracking clays to desert sandplains and dune fields with spinifex hummock grasslands and *Acacia* shrubland (Burbidge and Johnson, 2008). On the Dampier Peninsula, it usually prefers open woodland or forest pindan habitat, with less preference for pindan shrubland and other vegetation communities (Southgate, 2012). The Greater Bilby also prefers mixed shrublands dominated by *Acacia* and *Grevillea* along paleo-drainage systems (Southgate and Carthew, 2006). These habitat preferences align closely with the habitat found throughout the study area.

The presence of Greater Bilby was not confirmed during the field survey, however approximately 160 previous records have also been recorded from within 40 km of the Study Areas, and several recent surveys on the Dampier Peninsula have identified signs of Greater Bilby presence. The apparent lack of any burrows or significant foraging activity can only indicate that Greater Bilby were not present at the time of the field survey. Individuals could utilise habitats in either of the Study Areas in the future as home ranges are usually temporary and may suddenly shift when food availability changes (Burbidge and Johnson, 2008). Due to the temporary nature of Greater Bilby presence, a visual check of the area to be cleared should be completed immediately prior to any clearing activity to ensure no active burrows have been created since the field survey. If active burrows are located, a suitable buffer around the burrow should be avoided to limit impacts to any individuals inside the burrow.

The Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) has been recorded from *Acacia eriopoda* shrubland over *Chrysopogon fallax* grassland habitat during recent surveys conducted near the D2 Study Area. It is likely that the species occurs in this are on an infrequent basis when conditions are suitable due to the limited number of records. The movements patterns and occurrence of the species within the Broome region is not fully understood at the moment but it is likely that the species is a resident in the local area. Due to the large home range of the species, it is unknown how frequent the Spectacled Hare-wallaby would visit either study area; however, the habitat provides suitable conditions and

additional regiona records have been made from within 25 km south-east of the Study Area during a previous survey in 2017 (Ecoscape, 2017). Due to the highly mobile nature of Spectacled Hare-wallaby and the high noise and vibrations associated with clearing activity any individuals present with the clearance area are expected to flee the area immediately prior to clearing.

The Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*) is often recorded from The Broome townsite and is rarely recorded outside of the developed areas. This species prefers habitats that support large hollow bearing trees as they provide shelter with the surrounding habitats used for foraging. No individuals have been recorded from either of the Study Areas however due to its proximity to the Broome townsite, the D2 Study Area would be considered more likely to support this species. No suitably large trees were recorded from the D2 Study Area so this area would only support foraging. Suitable trees were recorded from the G1 Study Area however the likelihood of possums occurring in the areas is slightly lower. Unlike the Spectacled Hare-wallaby, the high noise and vibrations associated with clearing activity would cause any individuals to remain in any shelters such as tree hollows or hollow logs. These habitat structures should be avoided where possible during clearing activities.

Little is known about the ecology of the Dampierland Goanna (*Varanus sparnus*) however it is expected to be very similar to *Varanus brevicauda*, which utilises sandy spinifex dominated habitats. The Dampierland Goanna is thought to utilise the Pindan Shrubland habitats that cover most of the Damper Peninsula and is expected to utilise habitats within both Study Areas. Any individuals present within the clearance area are expected to flee the area immediately prior to clearing due to the high noise and vibrations associated with clearing activities.

The Study Areas do not constitute significant habitat for the six conservation significant bird species considered to have a medium likelihood of occurrence (Gouldian Finch (*Erythrura gouldiae*), Oriental Cuckoo (*Cuculus optatus*), Barn Swallow (*Hirundo rustica*), Fork-tailed Swift (*Apus pacificus*), Grey Falcon (*Falco hypoleucos*) and Peregrine Falcon (*Falco peregrinus*). Any individuals present within the clearance area are expected to flee the area immediately prior to clearing due to the high noise and vibrations associated with clearing activities.

4.3.3. Invertebrate SRE Fauna

Short Range Endemic invertebrates are defined by their dispersal limiting life history strategies. SRE taxa are associated with relictual micro habitats that typically have a higher humidity or moisture availability that the surrounding habitats. Impacts to SRE taxa are of greater concern due to the high potential to impact a large proportion of the total population due to their poor dispersal abilities and the relictual nature of their preferred habitats.

Of the SRE taxa identified from the WAM database searches, only four taxa (*Urodacus* `fossor?`, *Urodacus* `kraepelini`, *Quistrachia leptogramma* and *Rhagada bulgana*) have a high likelihood of occurrence and eight are considered to have a medium likelihood of occurence (*Aname* `MYG284`, *Aname* `MYG388`, *Kwonkan* `MYG285` and *Lychas* `JPP`, *Conothele* `MYG613`, *Conothele* `MYG615`, *Conothele* `MYG616`, *Conothele* `MYG617`). No habitat data is available for the four *Conothele* taxa identified above however a fifth taxa was recorded from remnant rainforest habitat which could form suitable habitat for all the taxa in this genus. Table 3.5 lists the likelihood of occurrence and potential impact to the taxa from the proposed clearing activities. Clearing activity conducted in either Study Area is not expected to have a significant impact.

5. CONCLUSIONS

5.1. Flora

The desktop assessment and literature review revealed five conservation significant flora species with a high likelihood of occurrence at the D2 study area and two species at the G1 study area. The field survey was able to adequately assess the presence or absence of long-lived, perennial species; however, due to poor seasonal conditions, herbaceous species such as *Jacquemontia* sp. Broome (P1), *Glycine pindanica* (P3) and *Polymeria* sp. Broome (P3) were less likely to be present and detectable during the reconnaissance survey. A survey conducted after sufficient rainfall in the period of March to May when these species are flowering would enable confirmation of the presence of absence of these species.

The Priority One tree species, *Corymbia paractia*, is known to occur on the boundary of the D2 Study Area, with previously undertaken distribution modelling (Environs Kimberley, 2018) indicating favourable habitat exists within the D2 Study Area. Despite the reconnaissance survey being undertaken in this species' peak flowering period (November – December), poor seasonal conditions meant that no flowering specimens were observed and therefore the species could not be identified with confidence. This means that this species cannot be said to be absent from the D2 study area and avoidance of impact to Eucalypt/Corymbia species should be minimised.

No introduced flora was recorded from either of the D2 and G1 Study areas.

The D2 Study Area is associated with more Priority Flora records than the G1 Study Area. Thus indicating G1 holds less local and regional conservation significance than the D2 Study Area.

5.2. Vegetation

The vegetation across both D2 and G1 Study Areas was assessed to be in excellent condition, with only minor grazing disturbances. Fire age varied between the Study Areas, with 80% of the G1 Study Area burnt within the last year, the remainder of the areas across D2 and G1 were burnt over five years ago.

Two TECs and four PECs were recorded from within 5 km of either the D2 and G1 Study Areas. However, the habitat assessed within the Study Areas did not resemble any TEC or PECs.

Despite the buffer zone for the P1 PEC, Mangarr (Minyjuru) (17327), being present within the north-western corner of the D2 Study Area, the habitat observed within the D2 Study Area is not typical of the habitat associated with the characteristic species, *Sersalisia sericea*. No *S. sericea* was recorded from the current survey. Additional survey effort in the area of D2 within the PEC buffer zone will confirm the presence or absence of this PEC. The 30 ha infrastructure footprint will also be designed in such a way that this portion of the D2 study area will be avoided.

The habitat within the D2 Study Area is considered significant as it provides suitable habitat for the priority flora species *Corymbia paractia* (P1) and lies within the modelled distribution of the species (Environs Kimberley, 2018).

Vegetation in the G1 Study Area is of lower conservation significance than the D2 Study Area.

5.3. Terrestrial Fauna

Clearing of either Study Area is not expected to significantly impact any terrestrial fauna species identified during this study. Preclearing searches for evidence of active Greater Bilby burrows should be completed immediately prior to any clearing activities.

Both Study Areas contain similar Pindan Shrubland habitats however the D2 Study Area is located closer to coastal habitats which may make it more suitable for some threatened fauna such as the Northern Brushtail Possum and several SRE invertebrate taxa identified from Broome and the James Price Point region.

6. RECOMMENDATIONS

Clearing of the proposed access tracks for site investigation at each of the D2 and G1 Study Areas is considered low impact. The DWER will assess the proposal and provide feedback on the level of further survey requirements; therefore, it is recommended to seek advice from DWER based on the findings and limitations of the reconnaissance survey. DWER will provide additional advice and impose any necessary conditions on the works. The following recommendations based on the results of the reconnaissance survey are made in order to minimise the impact on the environment and maximise the amount of environmental information recorded at the Study Areas to inform future decision making and approvals.

6.1. Flora

- Further survey effort in optimal seasonal conditions and at an appropriate time to detect the high likelihood of occurrence, herbaceous species (*Jacquemontia* sp. Broome (P1), *Polymeria* sp. Broome (P3), and to a lesser degree *Glycine pindanica* (P3)) would be beneficial in confirming their presence or absence within the Study Areas. Information available on the DBCA's database, FloraBase, suggests the optimal time for these herb species to be present and flowering lies between the months of March and May
- Due to the urgency of the project, submitting a clearing permit prior to the March to May period for the installation of temporary access tracks, boreholes and pits is recommended. The permit application could include the following disturbance mitigation measures:
    - Clearing at D2 to avoid Eucalypt/Corymbia species which have the potential to represent the Priority One species, *Corymbia paractia*
    - Clearing at D2 to avoid the north west corner which includes the buffer zone for the Priority One PEC, Mangarr (Minyjuru)
    - Clearing for access tracks and bore sites to be undertaken using a 'Front End Loader' (Wheel Loader) to remove vegetation, while limiting disturbance to the soil surface
    - It is possible that a trained Ecologist, familiar with the conservation significant species, could perform a clearance survey role in front of the machinery whilst clearing is taking place and inform operators to avoid conservation significant species. This will be possible in March when the herbaceous species are most detectable.
    - An experienced Ecologist could provide training to project personnel in the identification of conservation significant species to aid in future avoidance.

6.2. Fauna

- Immediately prior to clearing, a suitable qualified zoologist or country manager should walk along the clearing path to ensure no new active Greater Bilby burrows have been constructed post fauna survey. Clearance areas should be altered to avoid damaging active burrow systems. This activity can be completed in conjunction with cultural monitoring activities.

7. NATIVE VEGETATION CLEARING PRINCIPLES

An assessment on how the proposed vegetation clearing applies to the native vegetation clearing principles is present below in Table 7.1.

Table 7.1: Native Vegetation Clearing Principles

Principle number	Principle	Comment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	There were three Vegetation Types identified from the study areas derived from flat Pindan Plains. There were 45 taxa from 18 families and 34 genera recorded from five relevé sites. Proportion of flora collected was consistent with expectations for this type of survey and survey timing in the context of other surveys of a similar level and seasonality. Both study areas fall in the 750.1 Pre-European Vegetation mapping classification (see Section 1.6). This vegetation unit covers more than 1.2 million hectares, of which, approximately 99% is undisturbed. Given the species count, vegetation types, literature review and the Pre-European vegetation units, the vegetation at the study areas is not considered to have a high level of biological diversity.	Proposal at the study areas is not at variance with the principle.
(b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	Pindan Shrubland habitats identified within both Study Areas occur extensively across the Dampier Peninsula and is not considered a significant habitat type. The small area that is proposed to be cleared the Study Areas also limits any potential impacts to terrestrial fauna taxa	Proposal at the study areas is not at variance with the principle.

Principle number	Principle	Comment	Outcome
(c)	Native vegetation should not be cleared if it includes, or is necessary for, the continued existence of rare flora.	No rare or threatened flora were recorded from the study areas. One Threatened flora species *Seringia exastia* was identified in the database searches. This species is considered to have a medium likelihood of occurrence within the study areas. Suitable habitat for Threatened Flora *Seringia exastia* is not present at either of the study areas. One Priority One Flora *Corymbia paractia*, was recorded at the D2 Study Area in the desktop study. The presence of this Priority Flora was unconfirmed in the current survey, though given better seasonal conditions is highly likely to occur throughout. Of the 23 priority flora species returned in the database searches, five were considered to have Highly Likelihood of occurrence in the study areas. All of these Priority Flora have a High Likelihood of occurrence in the D2 Study Area. The D2 Study Area has suitable habitat for each of these taxa. They are: • *Jacquemontia* sp. Broome (P1); • *Glycine pindanica* (P3); • *Polymeria* sp. Broome (P3); • *Seringia katatona* (P3); and • *Terminalia kumpaja* (P3). Although the D2 Study Area includes conservation significant flora and has appropriate habitat for conservation significant flora, clearing of the D2 Study Area is unlikely to threaten the continued existence of the Priority One Flora, *Corymbia paractia*, and other Priority Flora with High Likelihood of occurrence. Vegetation at the D2 Study Area is not necessary for the continued existence of this conservation significant flora. No Priority flora were recorded at the G1 Study Area. Of the Five with High Likelihood of occurrence in the study areas, two have suitable habitat in the G1 Study Area. They are: • *Jacquemontia* sp. Broome (P1); and • *Polymeria* sp. Broome (P3); Although the G1 Study Area has appropriate habitat for conservation significant flora, clearing of the G1 Study Area is unlikely to threaten the continued existence of these priority Flora.	Proposal at the D2 Study Area is somewhat at variance with the principle. The Proposal at the G1 Study Area is not at variance with the principle.

Principle number	Principle	Comment	Outcome
(d)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a threatened ecological community.	One federally listed TEC (State listed Vulnerable) was identified from the database searches, Vine Thickets. An additional State listed, Vulnerable Ecological Community, Roebuck Bay mudflats was identified form the database searches. These ecological communities are associated with riparian vegetation and do not resemble any vegetation communities of the study areas. No TECs were recorded within the D2 Study Area. The D2 Study Area does not comprise the whole or part of, or is necessary for the maintenance of a TEC. One P1 PEC was identified as intersecting the north-west corner of the D2 Study Area; Mangarr (Minyjuru) (17327), a relict dune system dominated by extensive stands of Mangarr (Minyjuru) *Sersalisia* formerly (*Pouteria*) *sericea*. No *S. sericea* was recorded from the current survey. Typically, *Sersalisia sericea* occurs in dune systems closer to the coast, associated with vine thickets, beach forest and monsoon forest. The vegetation and habitat of the D2 Study Area is not typical of the habitat associated with *Sersalisia sericea*. Further clarification is needed to confirm presence/absence of the Mangarr (Minyjuru) PEC. There are four PECs within 5 km to the south of the D2 Study Area. Each of these PECs are associated with riparian communities and do not occur at the D2 Study Area. No PECs or TECs were recorded from the G1 Study area. Three PECs are within 10 km to the south of the G1 Study Area. Each of these PECs are associated with riparian communities and do not occur at the G1 Study Area. Native vegetation at the G1 Study Area does not comprise the whole or part of, or is necessary for the maintenance of a TEC.	Proposal at the D2 Study Area may be at variance with the principle. The Proposal at the G1 Study Area is not at variance with the principle.
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The Study Area is mapped as 100% 750.1; *Acacia tumida* shrubland with grey box and cabbage gum medium woodland over ribbon grass & curly spinifex, as defined by Beard (DBCA, 2009). The Pre-European Vegetation Mapping lists this vegetation unit to have cleared is less than 1% of the original extent of this vegetation unit. No vegetation at the Study Areas is significant as a remnant of native vegetation in an area that has been extensively cleared.	Proposal at the study areas is not at variance with the principle.

Principle number	Principle	Comment	Outcome
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no water courses, related wetlands or riparian vegetation in the study areas. One Ecological Community associated with a water course and state listed as Vulnerable occurs within 1 kilometre south of the study areas. This is Roebuck bay Mudflats; Species-rich faunal community of the intertidal mudflats of Roebuck Bay. Given the close proximity it is likely that water-flow through the study areas during times of heavy rainfall is associated with the Roebuck bay Mudflats.	Clearing at the study areas is unlikely to be at variance with the principle.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The total area to be cleared at the D2 Study Area is 30 ha. The Total area to be cleared at the G1 Study Area is 25 ha. Considering the small area proposed to be cleared, the history of minimal land clearing in the area and existing vegetation condition of the study area, it is unlikely that the proposed clearing will cause appreciable land degradation.	Proposal at the study areas is not at variance with the principle.
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	One Conservation area, Yawuru Birragun Conservation Park (WA_52354) is adjacent, directly to the west of the D2 Study Area. Clearing of approximately 30 ha to establish temporary tracks, bore holes and trial pits at the D2 study area is unlikely to impact the environmental values of the directly adjacent conservation park, Yawuru Birragun. No conservation areas are within the vicinity of the G1 Study Area as defined by the Land Management Act (1984) as National Parks, Nature Reserves, Conservation Reserve or other areas managed for biodiversity conservation. The clearing of vegetation (25 ha) in the G1 Study Area is not considered to impact on the environmental values of any adjacent or nearby conservation area.	Proposal at the D2 Study Area is not at variance with the principle. Proposal at the G1 Study Area is not at variance with the principle.
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The proposed clearing of native vegetation at D2 (30 ha) and G1 (25 ha) to establish temporary tracks, bore holes and trial pits at the D2 study area is not expected to cause deterioration in the quality of surface or underground water. However, the study areas are within 1 km of a water course (State listed Vulnerable ecological community, Roebuck bay Mudflats). Further site investigation works including hydrological surveys will provide more information as the project matures.	Proposal at the Study Areas is unlikely to be at variance with the principle.

Principle number	Principle	Comment	Outcome
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The remnant vegetation proposed to be cleared at the D2 and G1 study areas is 30 ha and 25 ha, respectively. These areas are small and are not expected to cause or exacerbate the instance of flooding.	Proposal at the study areas is not at variance with the principle.

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Appendix A: Likelihood of Occurrence of Significant Flora

Likelihood	Status	Family	Species	Key to Likelihood	Habitat	Source		
						TPFL	WA Herb	Literature Review
Recorded	1	MYRTACEAE	*Corymbia paractia*	≈ <5	Flats. Red Pindan sand dunes		•	•
High	1	CONVOLVULACEAE	*Jacquemontia sp. Broome (A.A. Mitchell 3028)*	≈ ♦	Brown orange sand on plain.		•	•
High	3	FABACEAE	*Glycine pindanica*	≈ <5	In disturbed pindan soil of roadside edges.	•	•	
High	3	CONVOLVULACEAE	*Polymeria* sp. Broome (K.F. Kenneally 9759)	≈ <5	Near-coastal plain. And; In red pindan soil on road verge and in drain.		•	•
High	3	MALVACEAE	*Seringia katatona*	≈ ♦	Red sand. Pindan vegetation. Scattered in open Eucalyptus woodland	•	•	
High	3	COMBRETACEAE	*Terminalia kumpaja*	≈ ♦	Pindan, sandy.		•	•
Medium	T	MALVACEAE	*Seringia exastia*	≠	Relict desert dune. Red sand. Peninsula. Red-orange sand.	•	•	
Medium	1	CONVOLVULACEAE	*Ipomoea tolmerana subsp. occidentalis*	≈	Margin of road in pindan plain. Eucalypt savannah woodland.	•	•	
Medium	3	FABACEAE	*Aphyllodium glossocarpum*	≈ <5	Margin of track in a pindan plain. Swampy margins of lagoon.		•	
Medium	3	CONVOLVULACEAE	*Bonamia oblongifolia*	≠	Pindan sandplain. Low-lying, semi-swampy area verging on pindan.		•	
Medium	3	GOODENIACEAE	*Goodenia byrnesii*	≈	Orange brown silty sand. Open Corymbia woodland.	•	•	
Medium	3	CONVOLVULACEAE	*Polymeria sp. Broome (K.F. Kenneally 9759)*	≈	Near-coastal plain. And; In red pindan soil on road verge and in drain.		•	
Medium	3	STYLIDIACEAE	*Stylidium pindanicum*	≠	In damp sand surrounding claypan		•	
Medium	3	FABACEAE	*Tephrosia pedleyi*	≈	Pindan Sandplain. Deep red sands on gently undulating sandplain. Yeeda Land System.		•	
Medium	3	AIZOACEAE	*Tetragonia coronata*	≠ <5	Cultivated pindan plain. Market garden.		•	
Low	1	ASTERACEAE	*Thespidium basiflorum*	≠	black soil with white sand. Melaleuca forest.		•	
Low	1	FABACEAE	*Aphyllodium parvifolium*	≠ ♦	In greyish pindan soil immediately adjacent to creek.		•	•
Low	2	AMARANTHACEAE	*Gomphrena pusilla*	≠	Coastal dune slope. Calcareous sand, sandstone. Sandy area between vine thickets.	•	•	
Low	3	CYPERACEAE	*Fuirena incrassata*	≠ ♦	On ironstone in grey sandy clay by quarry.	•	•	
Low	3	FABACEAE	*Acacia monticola x tumida var. kulparn*	≠	Exposed coastal clifftop site.		•	
Low	3	MYRTACEAE	*Lophostemon grandiflorus subsp. grandiflorus*	≠	Drainage basin. Salmon coloured sandy loam; grey		•	

Likelihood	Status	Family	Species	Key to Likelihood	Habitat	Source		
						TPFL	WA Herb	Literature Review
					brown sand			
Low	3	MENYANTHACEAE	*Nymphoides beaglensis*	≠ ♦	Grey/brown mud on the edge of a shallow pool. Floating aquatic herb.	•	•	
Low	3	STYLIDIACEAE	*Stylidium costulatum*	≠	In soakage area; Riparian woodland, Melaleuca viridiflora,		•	
Low	4	PITTOSPORACEAE	*Pittosporum moluccanum*	≠ ♦	Coastal sand dune crest and swales. Calcareous pale orange sand; Vine thicket in coastal dune pocket (leeward side of dune).	•	•	

Key to Likelihood: ≠ Habitat not present, ≈ Suitable habitat present, 5> recorded within 5 km of the Study Area, ♦ recorded more than 5 km but within 40 km of the study areas.

Appendix B: Relevé Site Data Collection Sheet

Details included in Relevé Sampling

- Site code, date; location;
- Botanist;
- Photograph;
- Vegetation condition (as defined in Table 2.2);
- Disturbances (grazing, weeds, tracks, mounds, litter, erosion, clearing etc.);
- Time since fire (<1 year, 1-2 years, 2-5 years, >5 years); and
- Landform, geology and soils, consistent with the Australian soils and land survey field handbook (National Committee on Soil and Terrain, 2009), including:
  - Flat: plain
  - Flat: valley floor
  - Flat: tidal
  - Slope: lower, mid, upper
  - Slope: cliff
  - Slope: simple
  - Slope: simple dune
  - Hillock
  - Crest: hill
  - Crest: dune
  - Crest: mesa
  - Ridge: hill
  - Ridge: dune
  - Open depression: drainage line
  - Open depression: creek/river
  - Open depression: floodplain
  - Closed depression: Lake edge
  - Closed depression: Swamp edge
  - Drainage line on slope: lower, mid, upper
- Slope: Level <1°, Very gentle 1°, Gentle 3°, Moderate 10°, Steep 23°, Very steep 37°, Precipitous 60° and Cliff 80°;
- Aspect: North, South, East, West;
- Soil: Sand, Clay, Loam, Sandy-clay, Hard-clay, Cracking-clay and Saline;
- Soil Colour: Dark, Light, Red, Orange, White, Grey, Brown, Black and Yellow;
- Rock Type: BIF, Calcrete, Creek stones, Dolerite, Granite, Ironstone, Shale, Quartz and Other;
- Rock Abundance: No rocks, Very few (<2%), Few (2-10%), Common (10-20%), Many (20-50%), Abundant (50-90%) and Continuous (>90%); and
- Rock Size: Fine gravel (<6 mm), Medium gravel (6-20 mm), Coarse gravel (20-60 mm), Cobbles (60-200 mm), Stones (200-600 mm) and Boulders (>600 mm).
- Dominant species – Crown cover (%) and Height (m); and
- Vegetation structure - NVIS Level V: three dominant species in three strata: upper, middle and ground (ESCAVI, 2003).

Appendix C: Relevé Site Data

Study area:	G1
Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Orange Sand; Clay;
Rocks:	-
Abundance:	No rocks
Size:	-
Fire:	1 - 2 years
Condition:	Excellent, Grazing (Low)
Notes:	-
Veg Unit:	2
Location:	POINT (122.5190795 -17.835792)

Vegetation description

Bauhinia cunninghamii open woodland over *Acacia eriopoda* and *A. platycarpa* sparse shrubland over *Grewia rustifolia* and *Pterocaulon intermedium* isolated clumps of heath shrubs over *Chrysopogon fallax* isolated clumps of tussock grasses. .

Study area:	G1
Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Orange Sand; Clay;
Rocks:	-
Abundance:	No rocks
Size:	-
Fire:	<1 year
Condition:	Excellent
Notes:	-
Veg Unit:	3
Location:	POINT (122.5249032 -17.8313439)

Vegetation description

Brachychiton diversifolius ssp. *diversifolius, Corymbia flavescens, C. greeniana* and *Eucalyptus tectifica* open woodland over *Acacia eriopoda* sparse shrubland over *Corchorus sidoides* isolated clumps of heath shrubs over *Chrysopogon fallax* and *Sorghum plumosum* isolated clumps of tussock grasses.

Study area:	G1
Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Orange Sand; Clay;
Rocks:	-
Abundance:	No rocks
Size:	-
Fire:	2 - 5 years
Condition:	Excellent
Notes:	-
Veg Unit:	3
Location:	POINT (122.5258259 -17.8347282)

Vegetation description

Bauhinia cunninghamii, Corymbia flavescens and *C. greeniana* open woodland over *Acacia eriopoda* sparse shrubland over *Sorghum plumosum* sparse tussock grassland over *Triodia ?caelestialis* isolated clumps of hummock grasses

Study area:	D2
Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Red Orange Sand; Clay;; Clay;
Rocks:	-
Abundance:	No rocks
Size:	-
Fire:	>5 years
Condition:	Excellent
Notes:	-
Veg Unit:	1
Location:	POINT (122.2707153 -17.8704444)

Vegetation description

Corymbia greeniana isolated clumps of trees over *Acacia eriopoda* open shrubland over *Acacia adoxa* var. *subglabra* isolated clumps of heath shrubs over *Chrysopogon fallax, Aristida inaequiglumis* isolated clumps of tussock grasses.

Study area:	D2
Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Orange Sand; Clay;
Rocks:	-
Abundance:	No rocks
Size:	-
Fire:	>5 years
Condition:	Excellent
Notes:	-
Veg Unit:	1
Location:	POINT (122.2718877 -17.8613389)

Vegetation description

Acacia eriopoda, A. colei, Ficus aculeata sparse shrubland over *Chrysopogon fallax* and *Sorghum plumosum* isolated clumps of tussock grasses over *Triodia ?caelestialis* sparse hummock grassland.

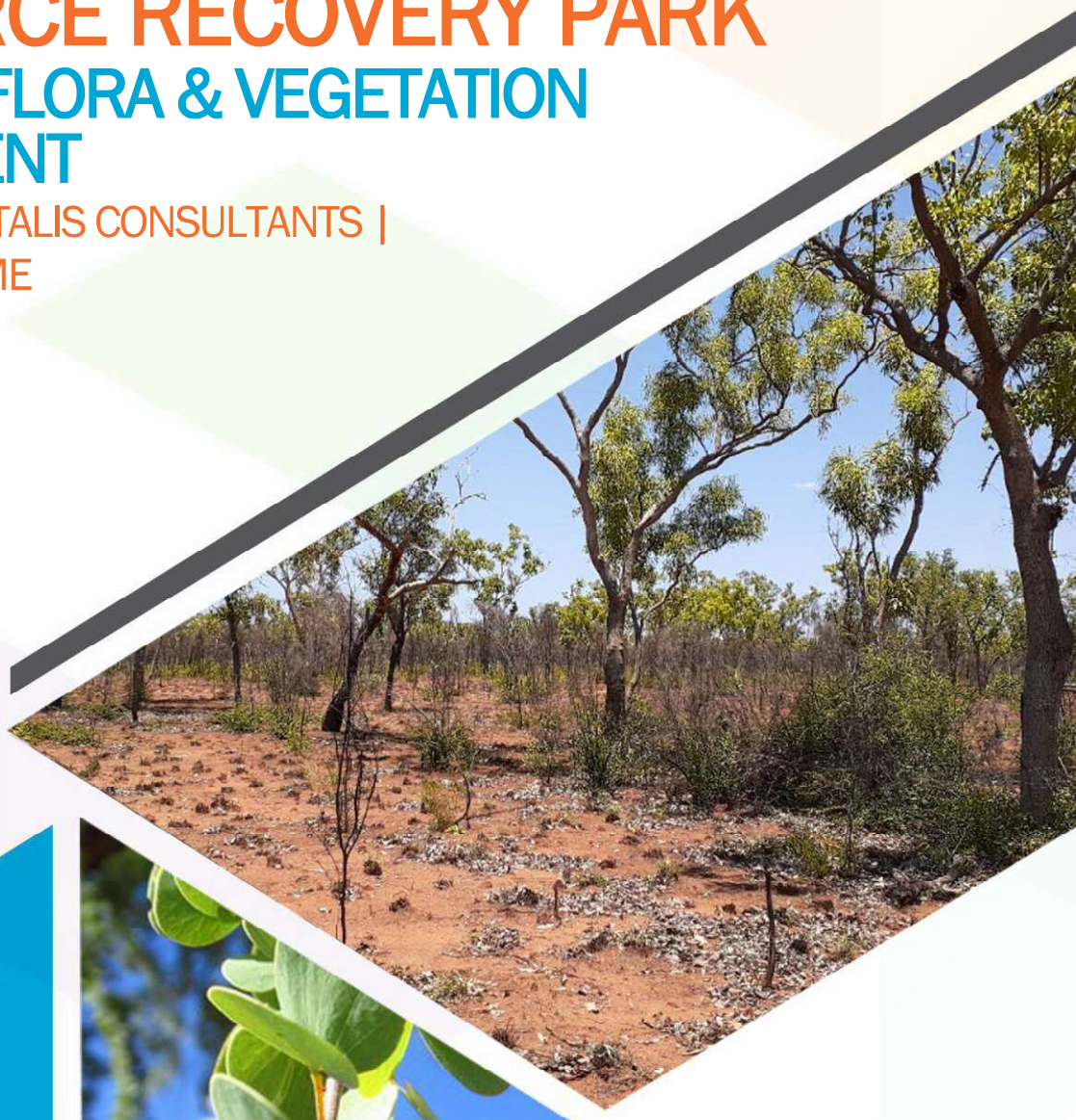
Appendix D: Species List – Flora

Family	Species
APOCYNACAEA	*Carissa lanceolata*
ASTERACEAE	*Pterocaulon intermedium*
COMBRETACEAE	*Terminalia canescens*
	Terminalia ferdinandiana
BORAGINACEAE	*Ehretia saligna* var. *saligna*
	Trichodesma zeylanicum
FABACEAE	*Acacia adoxa* var *subglabera*
	Acacia coleii
	Acacia eriopoda
	Acacia platycarpa
	Bauhinia cunninghamii
	Crotalaria medicaginea
	Cullen corallum
	Galactia tenuiflora
	Senna notabilis
GYROSTEMONACEAE	*Codonocarpus cotinifolius*
MALVACEAE	?MALVACEAE
	Brachychiton diversifolius ssp. *diversifolius*
	Corchorus sidoides
	Grewia brevifolia
	Grewia pindanica
MOLLUGINACEAE	*Trigastrotheca molluginea*
MORACEAE	*Ficus aculeata*
MYRTACEAE	*Corymbia flavescens*
	Corymbia greeniana
	Corymbia zygophylla
	Eucalyptus tectifica
PHYLLANTHACEAE	*?Phyllanthus* sp.
PLANTAGINACEAE	*Stemodia lathraia*
POACEAE	*Aristida ?inaequiglumis*
	Aristida holathera
	Chrysopogon fallax
	POACEAE sp.
	Sorghum plumosum
	Triodia ?caelestialis
	Triodia sp.
PROTEACEAE	*Grevillea pyramidalis*
	Hakea macrocarpa
	Persoonia falcata
RHAMNACEAE	*Ventilago viminalis*
RUBIACEAE	*Dentella misera*
	Gardenia pyriformis ssp. *keartlandii*
	Spermacoce occidentalis
SANTALACEAE	*Santalum lanceolatum*
SAPINDACEAE	*Atalaya hemiglauca*

BROOME REGIONAL RESOURCE RECOVERY PARK

DETAILED FLORA & VEGETATION ASSESSMENT

PREPARED FOR: TALIS CONSULTANTS | SHIRE OF BROOME



Spectrum ECOLOGY

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Report Details			
Project Description:	Broome Regional Resource Recovery Park Detailed Flora & Vegetation Assessment		
Prepared For:	Talis Consultants | Shire of Broome		
Project ID:	2008		
Version History	Author	Reviewer	Date of Issue
Version 2	Chris Shaw, Tim Hammer	Melissa Hay	3-July-2020

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EXECUTIVE SUMMARY

The Shire of Broome is investigating two sites ('D2' and 'G1' – the Study Areas) for the placement of a new community recycling centre and/or landfill. The D2 Study Area is 122 ha and located approximately 10 km north of Broome. The G1 Study Area is 98 ha and located approximately 33 km north-east of Broome. As part of the site investigations, a range of hydrogeological and geotechnical works are required which will involve the removal of native vegetation (approximately 2.5 ha for D2 and 3.0 ha for G1).

Talis Consultants, on behalf of the Broome Shire, commissioned Spectrum Ecology (Spectrum) to undertake a detailed flora and vegetation assessment for the Broome Regional Resource Recovery Park (RRRP) Project.

A total of 127 confirmed vascular plant taxa were recorded during the survey, of which four were introduced taxa. No Threatened Flora taxa were recorded in the survey. Three Priority Flora taxa have been recorded within D2 Study Area: *Corymbia paractia* (Priority 1), *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (Priority 1), and *Terminalia kumpaja* (Priority 3). No Priority species were recorded from G1 Study Area. All Priority Flora taxa recorded in the Study Areas were assessed to have low local and regional significance. None of the introduced flora are listed as Declared Pests in Western Australia.

No floristic Threatened Ecological Communities were recorded within the Study Areas. The desktop assessment found the Mangarr (Minyjuru) (P1) Priority Ecological Community (PEC) was present in north-west corner of the D2 Study Area. Scattered *Sersalisia sericea* (Minyjuru) trees were recorded in the D2 Study Area outside the current PEC; however, it is unlikely that these individuals indicate the presence of the Mangarr PEC. The *Corymbia paractia* (P1) PEC was likely recorded at the D2 Study Area based on the known distribution of *C. paractia*, abundance recorded in the survey, and the location of the Study Area. TEC or PECs are not likely to occur within the G1 Study Area.

One vegetation type was recorded within the two Study Areas and is described as: *Corymbia greeniana* low open woodland with *Acacia eriopoda* and *Bauhinia cunninghamii* tall open shrubland, over *Triodia schinzii* and *Triodia caelestialis* low sparse hummock grassland and *Chrysopogon pallidus* and *Sorghum plumosum* low sparse tussock grassland. The vegetation unit (V001) was considered to have low regional and local significance as the distribution was not restricted within the bioregion and did not provide habitat for restricted significant flora.

1. INTRODUCTION

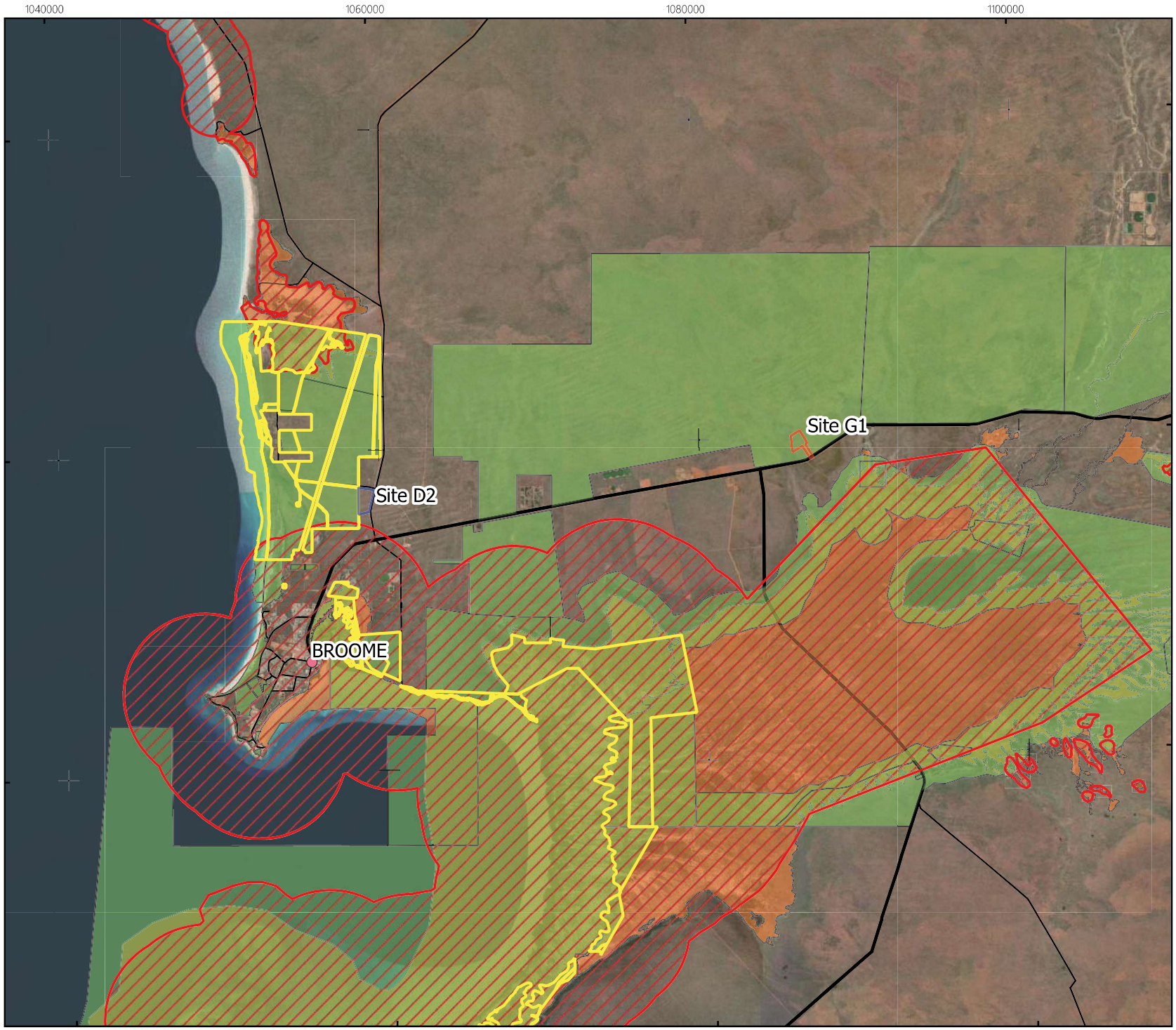
1.1. Project Background

The Shire of Broome is investigating two sites ('D2' and 'G1') for the placement of a new community recycling centre and landfill. The D2 Study Area is 122 ha and located approximately 10 km north of Broome. The G1 Study Area is 98 ha and located approximately 33 km north-east of Broome. As part of the site investigations, a range of hydrogeological and geotechnical works are required which will involve the removal of native vegetation (approximately 2.5 ha for D2 and 3.0 ha for G1). The disturbance to vegetation will include access tracks, boreholes, and trial pits. To allow such works to occur, a Native Vegetation Clearing Permit (NVCP) will be necessary and, as such, flora and fauna surveys are required to be undertaken in support of the NVCP application. Flora and Fauna surveys have previously been conducted at the G1 prior to the movement of the site boundary to its current location.

1.2. Objectives

Talis Consultants, on behalf of the Broome Shire, commissioned Spectrum Ecology (Spectrum) to undertake a detailed flora and vegetation assessment for the Broome RRRP Project. Spectrum Ecology previously conducted a reconnaissance flora and level 1 fauna survey at the D2 and G1 Study Areas in December 2019 to determine the environmental values present at the sites (Map 1.1) and provide support to relevant applications to undertake initial hydrogeological and geotechnical investigations for the development of the RRRP project.

The following is a brief technical report and survey data that satisfies the relevant regulatory guidance statements and documents the results, findings, and limitations of the survey.



Legend

- D2 Study Area
- G1 Study Area
- CAPAD Protected Areas
- Environmentally Sensitive Areas (ESA)
- Yawuru Indigenous Protected Area
- Directory of Important Wetlands

Roads

- Principal Road
- Minor Road

N

0 2 4 6 8 10 km

Scale 1:330,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 19-06-2020

Location of Study Area & Significant Lands

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map
1.1

1.3. Bioregion & Climate

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into regions based on dominant landscape, climate, lithology, geology, landform, and vegetation (Thackway & Cresswell, 1995).

The Study Area is located in the Pindanland (DAL02) IBRA subregion within the larger Dampierland (DAL) region (Figure 1.1). The Pindanland subregion comprises the western half of Dampierland, including the sandplains of the Dampier Peninsula, extending south along the hinterland of Eighty Mile Beach and north to include the paleodelta of the Fitzroy River (Graham, 2002). It is further described as having a fine-textured sand-sheet with low dunes covered by pindan vegetation, being the coastal, semi-arid, north-western margin of the Canning Basin (Graham, 2002). Inland vegetation typically consists of *Triodia* spp. (spinifex) or *Chrysopogon* spp. (ribbon grass) grasslands under *Acacia* spp. open shrub with low open woodlands of *Eucalyptus* species.

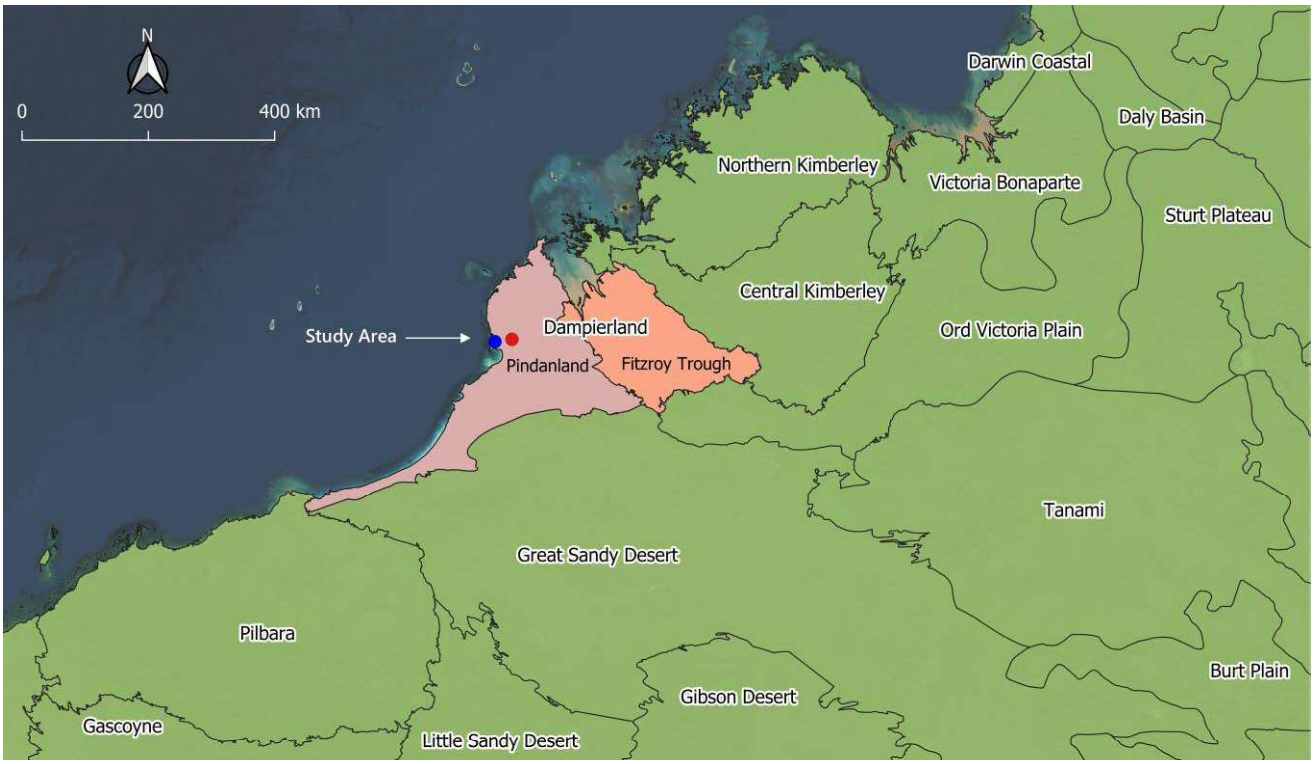


Figure 1.1: IBRA Classification of the Study Areas

The climate near Broome is dry, hot, and tropical and divided into a dry and wet season. The dry season runs from April to November, with very little rain and daily temperatures around 30°C. During the wet season, from December to March, average temperatures are several degrees higher along with erratic, often heavy rainfall, high humidity, and the possibility of tropical cyclones. The median annual rainfall is 561 mm, however the range of recorded annual rainfall is highly variable, from 132 mm to 1599 mm (Bureau of Meteorology, 2019).

1.4. Disturbance History

The dominant land uses for the Pindanland subregion include grazing on native pastures, unallocated crown land, and crown reserves. At the time of survey, the most recent fire within the Study Area and surrounds occurred in 2019.

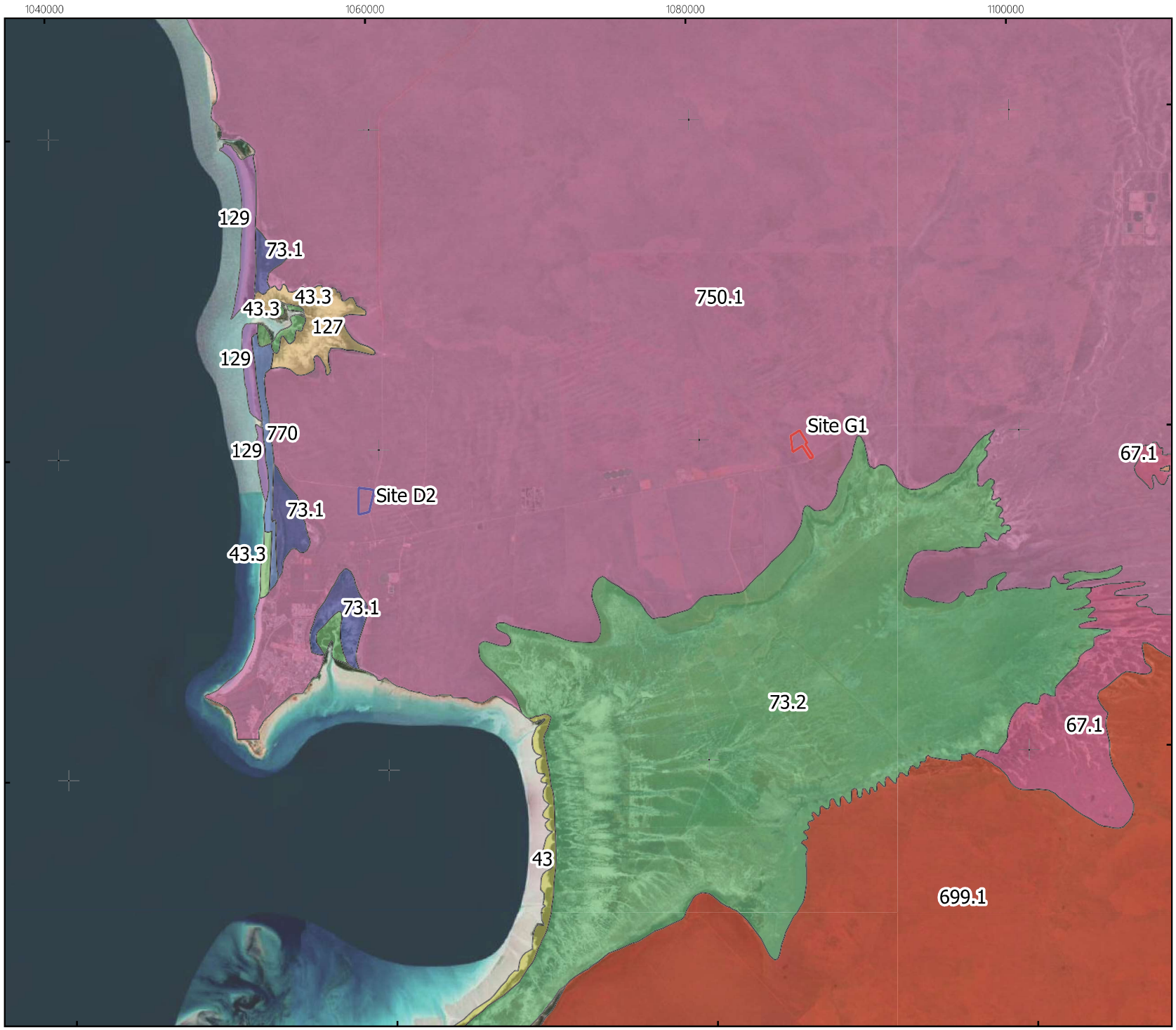
1.5. Beard Vegetation

Pre-European vegetation mapping was originally undertaken by J. S. Beard at various scales across the state and has since been updated to be consistent with the National Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (DPIRD 2020). State-wide vegetation statistics are available for these units, listing pre-European extent, current extent, and area in DBCA managed lands, are a useful tool to determine if a vegetation unit is rare or otherwise significant (WAGov, 2019). The unit mapped at the Study Areas has more than 99.7% of its pre-European extent remaining.

Both Study Areas occur entirely within one vegetation sub-association (750.1). This sub-association is restricted to the Dampierland IBRA region but is the second largest sub-association within the region and widespread. The vegetation classification is listed in Table 1.1 and presented in Map 1.2.

Table 1.1: Beard Vegetation

Sub-association	NVIS Level VI Vegetation Description	Area in Study (ha)	% of Study Area	Pre-European Whole State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Land
750.1	*Corymbia polycarpa*, *Corymbia papuana* and *Corymbia setosa* woodland, over *Acacia eriopoda*, *Acacia holosericea* and *Dolichandrone occidentalis* tall shrubland, over *Chrysopogon* sp. open tussock grassland	D2 – 122 G1 – 98	D2 – 100% G1 – 100%	1,221,911.2	1,218,020.5	99.7	2.7



Legend

- D2 Study Area
- G1 Study Area

Beard Vegetation Units

- 43.0
- 43.3
- 67.1
- 73.1
- 73.2
- 125.0
- 127.0
- 129.0
- 699.1
- 750.1
- 770.0

N

0 2 4 6 8 10 km

Scale 1:330,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 19-06-2020

Beard Vegetation

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map
1.2

1.6. Geology

The geology of Western Australia (WA) has been mapped at a scale of 1:50,000, 1:100,000, 1:250,000, and 1:500,000. The township of Broome has been mapped to the finer scale 1:50,000 (Map 1.3), the surrounding region limited to a 1:250,000 and 1:500,000 scales.

Both study areas are located over the Broome, Mowla and Melligo Sandstones (K-bm-st) 1:500,000 geological unit, the total extent of this geological unit is 2,260,980 ha in WA and 1,980,210 ha in the Dampierland IBRA. The K-bm-st geological unit mapped at the Study Areas is widespread across WA and the Dampierland IBRA. The unit has less than 0.001% of its total occurrence within the Study Areas.

The D2 Study Area occurs within the Sm10 (1:50k) and Qz (1:250k) geological units. Both units are described as homogenous fine-grained red sands. The G1 Study Area is located over the Qs (1:250k) geological unit which is comprised of sand and silt and occurs extensively in the surrounding region. Extrapolating from the 1:50,000 geological units, the G1 site likely falls within the Sm10 (1:50k) geological unit (Table 1.2; Map 1.3). The geological units are listed in Table 1.2 and mapped at 1:50,000 in Map 1.3.

Table 1.2: Geological Units

Scale	Code	Description	Area in Study Area (ha)	% of Study Area
D2 Study Area				
1:50k	Sm10	Silky sand: red, fine-grained, sub-rounded quartz, variable silt content, homogeneous	122	100%
1:250k	Qz	Red sand, fine to medium; minor silt; aeolian	122	100%
1:500k	K-bm-st	Fine- to coarse-grained sandstone; minor mudstone and conglomerate	122	100%
G1 Study Area				
1:50k*	Sm10	Silty sand: red, fine-grained, sub-rounded quartz, variable silt content, homogeneous	98	100%
1:250k	Qs	Sand, silt; minor gravel: mixed alluvial and aeolian	98	100%
1:500k	K-bm-st	Fine- to coarse-grained sandstone; minor mudstone and conglomerate	98	100%

*Estimate based on 1:50,000 and 1:250,000 geological units.

1.7. Land Systems

Study Areas are on the boundary between Yeeda and Wanganut land systems (Schoknecht & Payne, 2011). The Yeeda land system is dominated by red sandplains supporting pindan vegetation with dense *Acacia* shrubs, scattered bloodwood and grey box trees and curly spinifex and ribbon grass. The Wanganut land system is dominated by low-lying sandplain and dunefields with through-going drainage (Schoknecht & Payne, 2011). The land systems associated with the Study Areas are presented in Table 1.3 and Map 1.4.

Table 1.3: Land Systems

Land System	Description	Area in Project (ha)	Total Extent (ha)	Location & Description of Occurrence
Yeeda	Sandplain, deep red and yellow sands, pindan and tall woodlands.	D2 – 24 G1 – 95	2,130,800	Widespread across the Dampierland IBRA region. Predominantly found on the Pindanland IBRA subregion.
Wanganut	Low-lying sandplain and dunefields with through-going drainage, pindan.	D2 – 98 G1 – 3	697,300	Located in the northern half of the Dampierland IBRA region. Found evenly across both the Pindanland and Fitzroy Trough IBRA subregions.

Legend

- D2 Study Area
- G1 Study Area

Geological Units 1:50,000

- C3
- Gsb1
- LS1
- M5
- Made grd
- S1
- S14
- S17
- S2
- S7
- Sm10
- Sm8
- Sm9
- SS3
- Ocean

N

0 2 4 6 8 10 km

Scale 1:330,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

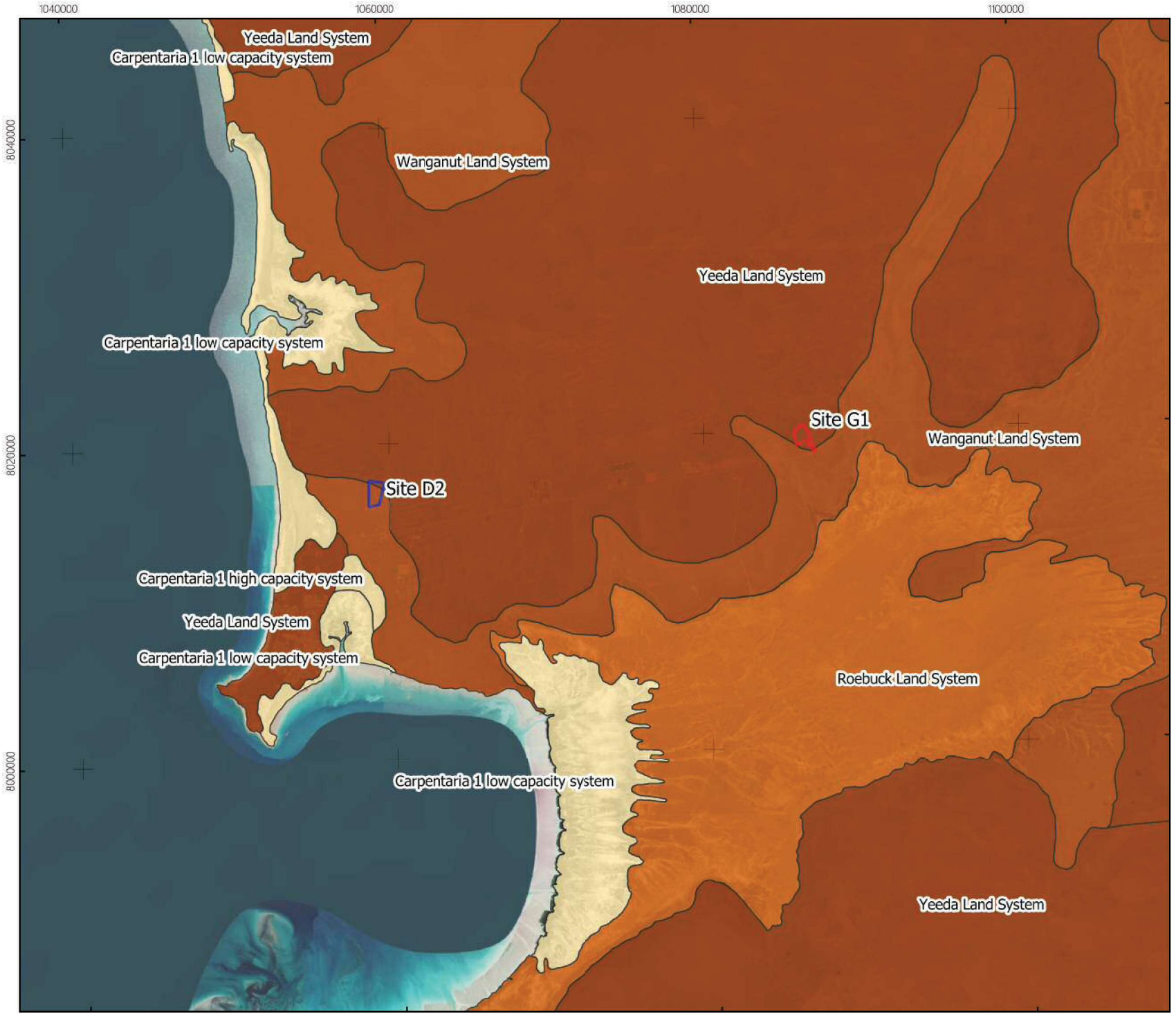
Date: 19-06-2020

Geology (1:50,000)

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map
1.3



Legend

- D2 Study Area
- G1 Study Area

Land Systems

- Carpentaria 1 high capacity system
- Carpentaria 1 low capacity system
- Roebuck Land System
- Wanganut Land System
- Yeeda Land System

N

0 2 4 6 8 10 km

Scale 1:330,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 19-06-2020

Land Systems

Broome Regional Resource Recovery Park

Map 1.4

Prepared for
Talis | Broome Shire

1.8. Significant Lands

1.8.1. Environmentally Sensitive Lands

Environmentally Sensitive Areas (ESA) that are associated with flora and vegetation are areas that are defined by the Department of Water and Environmental Regulation (2019) as:

- A defined wetland and the area within 50 m of a wetland;
- The area covered by vegetation within 50 m of Threatened Flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened Flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gnangara Mound Crown Land Policy and Western Swamp Tortoise Policy; and
- Areas covered by lakes, wetlands and fringing vegetation of the Swan Coastal Plain Lakes Policy, including South West Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy.

No ESAs were mapped within the Project. Both Study Areas are located to the north of a large ESA that comprises the Roebuck Bay and associated Roebuck Plain areas (Map 1.1).

1.8.2. Australian Wetlands Database

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DoEE, 2019).

No nationally significant wetlands, including Ramsar wetlands, were mapped within the Project (Map 1.1).

1.8.3. Conservation Estate

A search of the Collaborative Australian Protected Area Database (CAPAD), identified several protected areas located within 50 km of the Study Areas. These protected areas and their approximate distance from the Study Areas are listed in Table 1.4.

The G1 Study Area is located within the Yawuru Indigenous Protected Area (IPA). The combined area of the 5(1)(h) Reserves listed in Table 1.4 make up a small portion of the greater Yawuru IPA. The D2 Study Area is not located within any protected areas though is immediately east of the Yawuru Birragun Conservation Reserve. Conservation Estate, ESAs, nationally significant wetlands, and the extent of the Yawuru IPA are displayed on Map 1.1.

Table 1.4: Significant Lands Within 50 km of the Study Areas

Reserve Name (Protected Area ID)	Relevant to the Study Area		Jurisdiction/ Size
	Distance	Direction	
5(1)(h) Reserves			
Broome Bird Observatory (WA_41066)	D2 – 13.8 km G1 –23.9 km	Southeast Southwest	Western Australia, 2.7 ha
Broome Wildlife Centre (WA_47964)	D2 – 6.5 km G1 – 32.3 km	Southwest West southwest	Western Australia, 5.0 ha
Unnamed (WA_51105)	D2 – 11.9 km G1 –26.6 km	South Southwest	Western Australia, 317.0 ha
Yawuru Conservation Estate (WA_51162)	D2 – 5.5 km G1 – 30.5 km	West West	Western Australia, 2,515.6 ha
Unnamed (WA_51497)	D2 – 4.6 km G1 – 28 km	South Southwest	Western Australia, 716.5 ha

Reserve Name (Protected Area ID)	Relevant to the Study Area		Jurisdiction/ Size
	Distance	Direction	
Unnamed (WA_51583)	D2 – 11.9 km G1 – 13.3 km	Southeast Southwest	Western Australia, 4,896.0 ha
Unnamed (WA_51617)	D2 – 13.6 km G1 – 24.9 km	Southeast Southwest	Western Australia, 5.7 ha
Unnamed (WA_51932)	D2 – 19.4 km G1 – 20.8 km	Southeast Southwest	Western Australia, 5,778.5 ha
Yawuru Birragun Conservation Park (WA_52354)	D2 – Directly adjacent G1 – 25km	West West	Western Australia, 7,223.8 ha
Indigenous Protected Areas			
Yawuru (CWTH_IPA75)	D2 – Directly adjacent G1 – Located within IPA	West Within	Commonwealth of Australia, 210,763.7 ha

2. METHODOLOGY

2.1. Project Team & Licenses

Spectrum Ecology staff involved with this assessment are listed in Table 2.1, along with their role, years of experience and relevant licenses.

Table 2.1: Project Team & Licences

Staff	Role	Experience	Licences
Melissa Hay (Principal Botanist)	Reporting, QA	12 years	-
Chris Parker (Senior Botanist/Ecologist)	Field Assessment, reporting, data analysis	10 years	Flora: FB62000009-2
Chris Shaw (Botanist)	Field Assessment, reporting, data analysis	3 years	Flora: FB62000241
Dr Tim Hammer (Taxonomist/Botanist)	Plant IDs, reporting	5 years	-

2.2. Field Survey Timing

Climate data and conditions leading up to the detailed flora survey recorded at Broome Airport (Bureau of Meteorology station #003003) are presented in Figure 2.1 and Table 2.2. The D2 and G1 Study Areas are located approximately 10 km north-north-east and 33 km east-north-east of the Broome Airport weather station, respectively.

The reconnaissance flora survey was undertaken after a period of below annual rainfall. Broome Airport recorded 265 mm under the median total annual rainfall (Table 2.2).

Total rainfall for the 12-month period prior to the detailed flora survey (April 2019–March 2020) was 512 mm, 49 mm higher than the median total annual rainfall recorded at Broome Airport (561 mm). Total rainfall for the three-month period prior to the field survey (January–March) was 433 mm, 3 mm above the long term median for the same period of time (430 mm) (Table 2.2). Seasonal conditions were above median for the timing of the detailed field survey, as recommended by the technical guidance (EPA, 2016b).

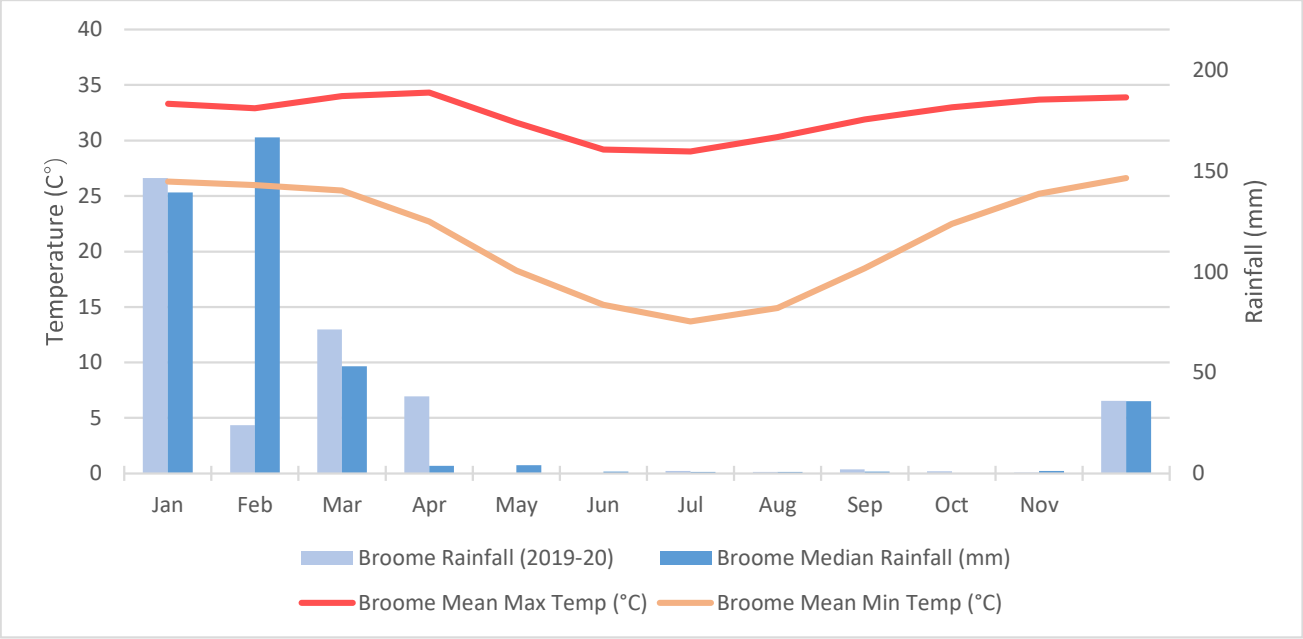


Figure 2.1: Climate Data (1940-2020) for Broome Airport (#003003)

Table 2.2: Field Survey Timing & Rainfall

Field Survey	Date	Person Days	BOM Station	Rainfall (mm)					
				3 Months Prior	3 Month Median	+/-	12 Months Prior	Annual Median	+/-
Reconnaissance flora survey	26 Nov 2019	1	Broome Airport	4	5	-2	296	561	-265
Detailed flora survey	19 – 23 April 2020	10	Broome Airport	433	430	3	512	561	49

2.3. Legislation & Guidelines

Flora and fauna in Western Australia are protected by various legislation, including:

- The State *Biodiversity Conservation Act 2016* (BC Act);
- The National *Environmental Protection Act 1986* (EP Act); and
- The National *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This detailed assessment is compliant with the appropriate flora guidelines as outlined in:

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

2.4. Significant Flora & Vegetation Definitions

Flora and vegetation can be considered significant for a range of reasons.

Significant flora can include (EPA, 2016a):

- Being identified as Threatened: Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Being identified as Priority species: Priority 1 to 4 (DBCA, 2019);
- Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly, at the extremes of range recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation can include (EPA, 2016a):

- Threatened Ecological Community (TEC): Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Priority Ecological Community (PEC): Priority 1 to 5 (DBCA, 2020);
- Restricted distribution;
- Degree of historical impact from threatening processes;
- A role as a refuge; or
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

2.5. Introduced Flora & Declared Plant Categories

Introduced flora can pose a threat to native vegetation and biodiversity. The Department of Primary Industries and Regional Development (DPIRD) keeps a database of organisms that are declared pests in Western Australia. This database is regulated under the Biosecurity and Agricultural Management Act (WA Gov, 2007). The legal status and control requirements for these environmentally significant weeds are provided in Appendix A.

2.6. Nomenclature

Flora nomenclature used in this report is consistent with the DBCA Census of Western Australian Plants database, provided through FloraBase (Western Australian Herbarium, 2020) and is current at the time of report preparation.

2.7. Desktop Assessment

A desktop review of all relevant and available flora and vegetation data sources was undertaken prior to the field survey to determine the species and communities that are likely to occur in the Study Area. This review included searches of relevant databases and a review of relevant literature from the surrounding region.

2.7.1. Database Searches

The database searches completed for this project are listed in Table 2.3.

Table 2.3: Details of Database Searches

Data Source	Custodian	Details
Threatened & Priority Flora database (WAH/TPFL)	Department of Biodiversity, Conservation and Attractions (DBCA)	Date: 26/11/2020 Buffer: 50 km around a central point Reference: 27-1119FL
TEC & PEC database		Date: 17/12/2019 Buffer 50 km around a central point Reference: 15-0219EC
Commonwealth Protected Matters Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 13/11/19 Buffer: 40 km
NatureMap	Department of Parks and Wildlife (DPAW) / Western Australian Museum	Date: 13/11/19 Centre point: 17°54'10"S, 122°20'17"E Buffer: 40 km
Index of Biodiversity Surveys of Assessments (IBSA) database.	Department of Water and Environmental Regulation (DWER)	Date: 10/01/2020

2.7.2. Previously Conducted Flora Assessments

A desktop review of all relevant and available literature was undertaken prior to the field assessment. The following previous survey reports were searched to determine species of conservation significance likely to occur in the Study Area. The Index of Biodiversity Surveys and Assessments (IBSA) was also utilised to access available previous assessment reports from the surrounding region. Details of each report are summarised in Table 2.4 and mapped in Map 2.1.

Table 2.4: Previously Conducted Flora Assessments

Report Title	Level of Assessment	Field Survey Timing
Mamabulanjin Orchard Flora and Fauna Survey (GHD, 2019).	Detailed and targeted flora & vegetation. Level 1 and targeted fauna.	1–2 May 2019 (flora & vegetation).
Distribution, ecology and cultural importance of Gunurru or Cable Beach Ghost Gum *Corymbia paractia* in the Broome area, Western Australia (Environs Kimberley, 2018).	Targeted survey and distribution mapping of Cable Beach Ghost Gum *Corymbia paractia*.	November – December 2016 (flowering period).
Broome Road Industrial Area Targeted Survey (GHD, 2018).	Targeted flora survey (*Polymeria* sp. Broome and *Jacquemontia* sp. Broome).	24–27 April 2017, 10–12 May 2017.
Flora, Vegetation and Fauna Assessment – Broome Asparagus Farm (AECOM, 2017).	Detailed (single phase) flora & vegetation, Level 1 fauna.	8–12 May 2017 (Flora).
Broome Landfill Flora, Vegetation and Fauna Survey (Astron, 2017).	Level 2 flora & vegetation, Level 1 fauna.	2–3 November 2016 (Flora & Fauna). 3–5 April 2017 (Flora).
Broome Motorplex Environmental Site Investigation (GHD, 2016).	Level 2 (single phase) flora & vegetation.	18–24 March 2016 (flora & vegetation).
Priority Ecological Community (PEC) Mapping and condition assessment: "Relict dune system dominated by extensive stands of Mangarr (Minyjuru) *Sersalisia* (formerly *Pouteria*) *sericea*" (Willing & Beames, 2015)^	Targeted survey and condition assessment of the Minyjuru (*Sersalisia sericea*) dominated relict dune system PEC.	November 2013 – March 2014.
Broome North – Northern Portion (Area B). Preliminary Environmental Impact Assessment and Biological Survey (GHD, 2009).	Level 1 flora & vegetation.	Field: 3–6 June 2008.

^ Exact location not known

Legend

- D2 Study Area
- G1 Study Area
- Broome Motorplex Sites (GHD 2016)
- Mamabalanjin Orchard (GHD 2019)
- Targeted Corymbia (Environs Kimb 2018)
- Cable Beach Rd East (GHD 2016)
- Broome Industrial Targeted (GHD 2018)
- Broome Asparagus Farm (AECOM 2017)
- Broome Landfill G1 RevA (Astron 2017)
- Broome North Area B (GHD 2009)
- Principal Road
- Minor Road

N

0 2 4 6 8 km

Scale 1:210,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 11-06-2020

Previously Conducted Flora Assessments

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map
2.1

2.7.3. Number of Plants

The significant flora records from the database searches and literature review vary considerably in the amount of detail, regarding abundance, that is available. Ranging from accurate counts, foliage cover, and general descriptions to no detail at all. Where no value was provided for abundance, the numbers were inferred according to Table 2.5. The assumption of value is likely to be an underestimate and hence final estimates are likely to be conservative. Where a range of potential abundance is provided, the lower middle value of the range was used. Exact duplicates were removed and where abundance values differ, the larger number was used.

Table 2.5: Number of Plants Assumed

Description or Cover Provided	Cover (%)	# Plants Assumed
No value	-	1
Rare, few, scattered, some, isolated plants, isolated clumps, very sparse, uncommon	<2%	3
Several, small group, scarce, sparse, scattered, small population, dozens	2-10%	10
Infrequent, uncommon, many, medium sized patch	10-30%	20
Occasional, moderately common, localised, large patch	30-70%	30
Common, Locally common, locally frequent, locally scattered, locally abundant, mid-dense, healthy population	>70%	50
Frequent, very common, plentiful, abundant, dominant, extensive, dense	>70%	100

2.7.4. Likelihood of Occurrence Assessment

The following information was collated for each significant flora taxon or vegetation community identified during the desktop assessment:

- Conservation status (EPBC Act, WC Act, DBCA listing);
- Description of species and flowering period (flora only);
- Description of habitat requirements and presence within the Project;
- Source of record (DBCA, previous report etc.); and
- Distance of record to the Project.

A likelihood of occurrence assessment was then conducted using the criteria listed in Table 2.6. This included assessing the distance of the record from the Study Areas (historical database records considered not accurate were excluded if required), and presence of appropriate habitats within the Study Areas (using land systems, geology, vegetation mapping, and/or aerial imagery).

Table 2.6: Likelihood of Occurrence Assessment Criteria

Likelihood	Flora & Vegetation
Recorded	Species or vegetation community accurately recorded within the Study Area during the literature review (includes TEC/PEC buffers that intersect).
High	Species or vegetation community recorded in close proximity of the Study Area, and suitable habitat does, or is likely to occur.
Medium	Species or vegetation community recorded outside the Study Area but within 20 km and suitable habitat may occur.
Low	Species or vegetation community rarely or not recorded within 20 km of the Study Area and suitable habitat does not likely occur within the Study Area.

2.7.5. Data for the Index of Biodiversity Survey's for Assessment (IBSA)

The Environmental Protection Authority has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package.

All survey data collected will be provided electronically to comply with IBSA data standards.

2.8. Detailed Flora & Vegetation Assessment

2.8.1. Field Methodology & Sampling Effort

A reconnaissance level flora and vegetation assessment was previously conducted at the Study Areas in November 2019. This was considered appropriate as it is the preliminary investigation into environmental values of the Study Areas. The detailed flora survey was conducted in the months following the wet season (February – April).

During the reconnaissance survey, five relevés were sampled within the Study Areas; including two relevés at D2 Study Area, three relevés in G1 Study Area. The detailed flora survey across both Study Areas was comprised of:

- Five 50 × 50 m quadrats (one located outside the Study Area);
- Five relevés (three located outside the Study Area); and
- 45 km of traverses with 100m spacing.

A combination of quadrats, relevés, traverses, and opportunistic sampling is appropriate for a detailed level survey as stipulated in the guidance statement (EPA, 2016b). These survey techniques are described in Table 2.7. Sites and traverses surveyed at the Study Areas are mapped in Map 2.2 and Map 2.3, respectively.

Table 2.7: Detailed Flora & Vegetation Assessment Survey Technique

Technique	Description
Quadrat	Quadrats are a comprehensive survey technique for gathering information for detailed flora and vegetation surveys. Each vegetation unit must be represented by a minimum of three quadrat sites over two seasons and have at least one corner (NW) permanently marked. Information collected at each quadrat includes: • Site code, date, location, botanist; • Four photographs, one from each corner of the site; • Vegetation condition and disturbances (including fire); • Landform, including slope, soil, rock type, aspect; • Flora and vegetation information; dominant cover, structure and species count where necessary; and • Comprehensive recording of every species within the quadrat boundary (50 × 50 m).
Relevés	Relevés used in a detailed survey are employed to support the vegetation mapping and survey effort. They are a lower intensity survey technique or sampled where quadrats are too dangerous to set up. Information collected at each relevé is the same as that of a quadrat site, excluding the comprehensive collection of every species within the quadrat boundary, and the requirement to permanently mark the site's corners.
Traverses	A traverse is an unmarked route along which data is collected. Traverses are useful for identifying the boundaries and characteristics of vegetation types, selecting sites for detailed survey, and targeting significant flora or vegetation. Information recorded along a traverse is as for the relevé, with the addition of noting vegetation changes and relationships between vegetation and substrate.

Technique	Description
Opportunistic Sampling	Flora and vegetation not recorded through other sampling methods was opportunistically sampled as encountered in the study area. Opportunistic sampling also included recording locations of significant, introduced (weed) and unknown species.
Targeted Sampling	Areas likely to support significant flora or vegetation were targeted during the survey, including areas with existing records of significant flora. Areas were selected based on existing records from database searches, geology, vegetation mapping and known Environmentally Sensitive Areas. Where possible, unusual, and restricted geological features within the study area were sampled. When potentially significant flora were encountered during the survey, sufficient information was recorded to complete a Threatened and Priority Flora Report Form (TPRF).

Legend

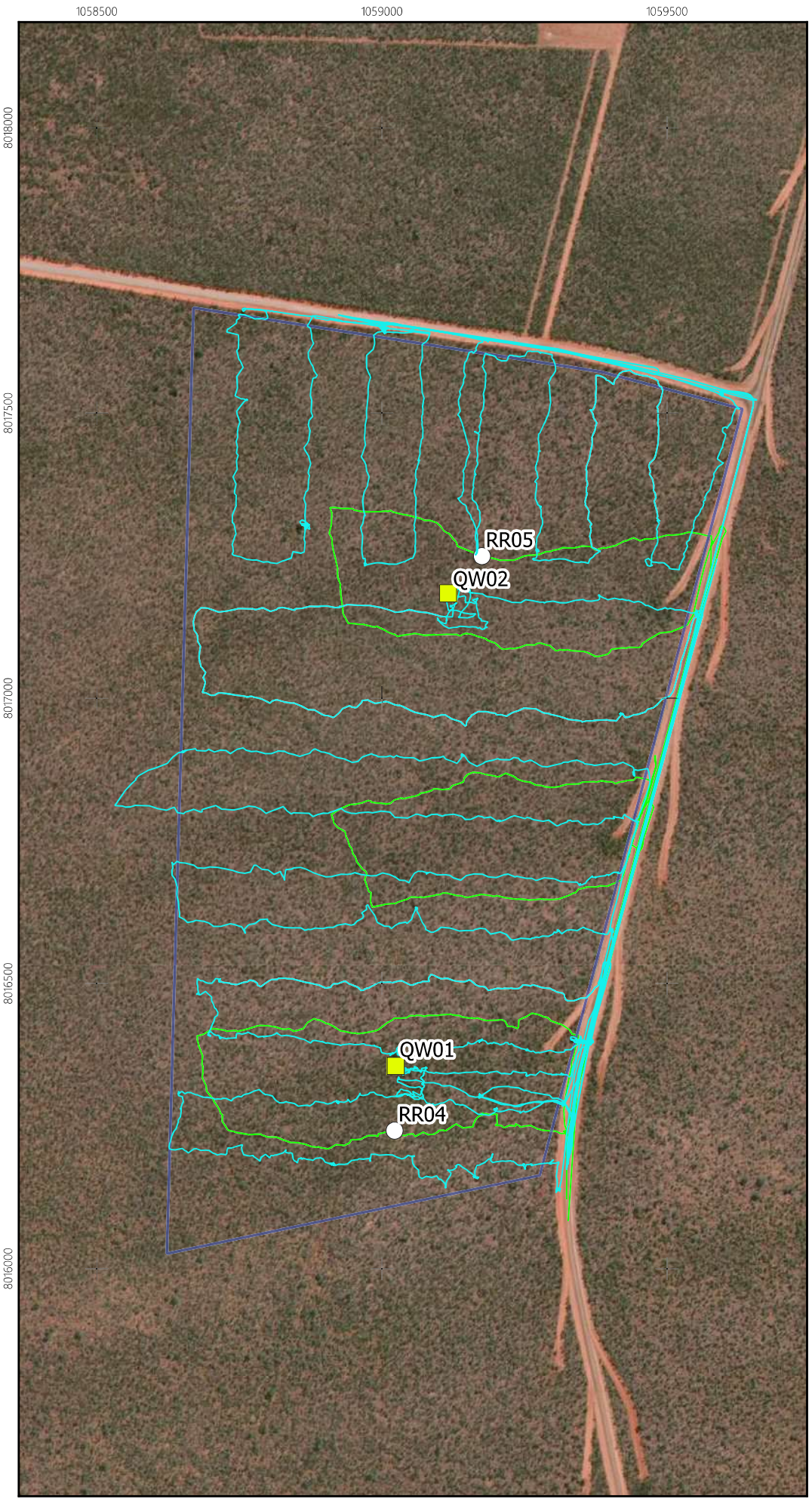
- D2 Study Area

Detailed Flora Survey

- Quadrat
- Site Traverse

Reconnaissance Flora Survey

- Releve
- Site Traverse



Spectrum ECOLOGY

Date: 19-06-2020

Author: CS

N

0 0.2 0.4 km

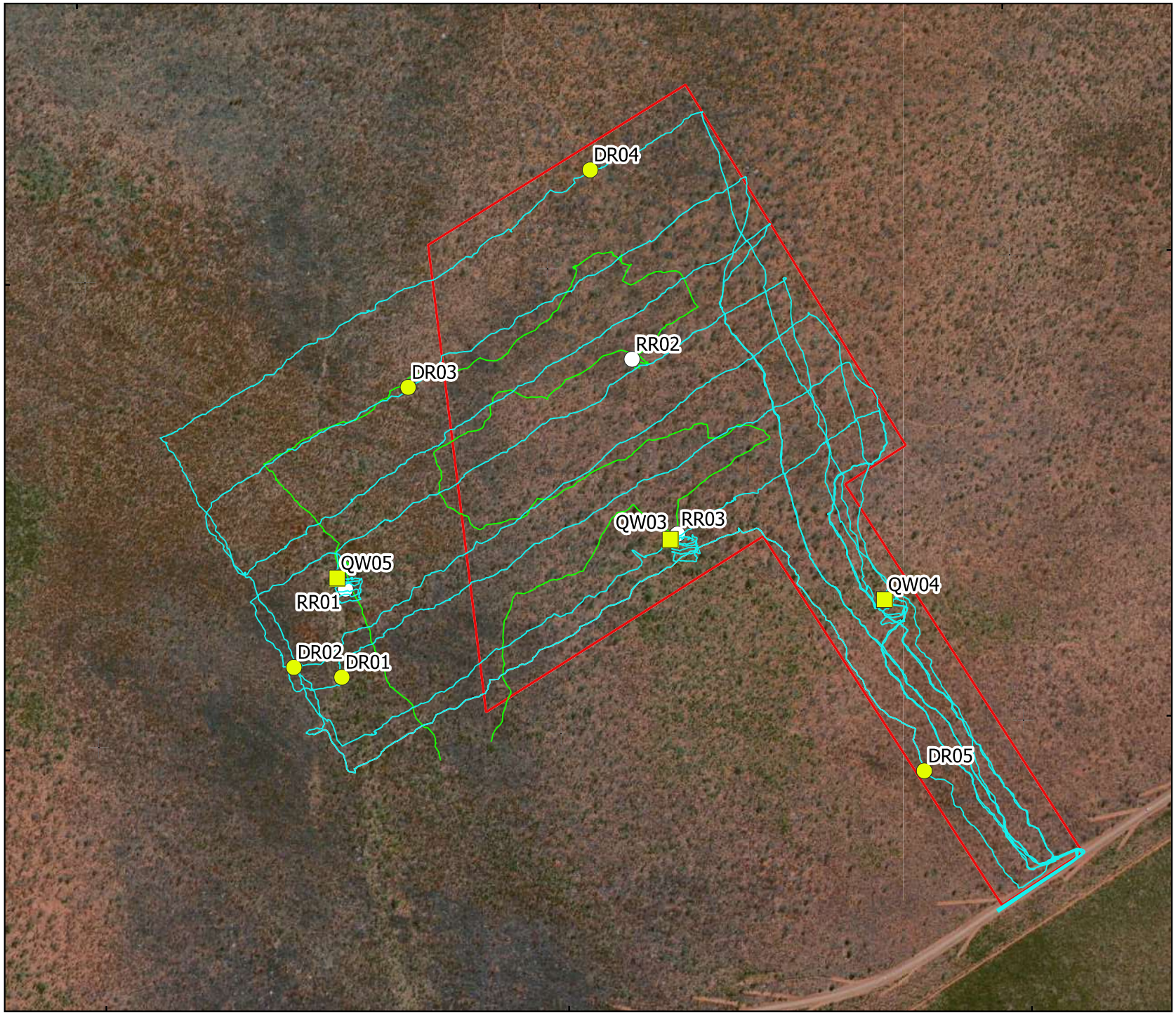
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Scale 1:10,000

D2 Study Area
Flora Survey Effort

Broome Regional Resource Recovery Park

Map 2.2



Legend

- G1 Study Area

Detailed Flora Survey

- Quadrat
- Releve
- Site Traverse

Reconnaissance Flora Survey

- Releve
- Site Traverse

N

0 0.2 0.4 km

Scale 1:12,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 12-06-2020

G1 Study Area
Flora Survey Effort

Broome Regional Resource Recovery Park

Map 2.3

Prepared for
Talis | Broome Shire

2.8.2. Vegetation & Condition Mapping

The data collected from relevés, traverses, as well as general field notes, observations and aerial photography were used to map the vegetation across the study areas. Vegetation was classified structurally based on the dominant species. The vegetation classification is consistent with NVIS Level V – association vegetation descriptions (referred to as a 'vegetation unit' for the local scale in this report). This level of description provides information on the dominant growth form, height and cover for up to three species for each of the upper, mid and ground strata (ESCAVI, 2003).

Vegetation condition was recorded at relevés and where areas of different vegetation condition were observed from both ground truthing and aerial imagery. The vegetation condition was mapped across the study area at the same scale as the vegetation mapping. Vegetation condition ratings follow the scale recommended for the Northern Botanical Province (EPA, 2016), summarised in Table 2.8.Table 2.8

Table 2.8: Vegetation Condition Scale & Criteria – Northern Province

Vegetation Condition	Disturbance Criteria
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	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
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.

2.8.3. Specimen Identification & Lodgement

Flora specimens were collected of any suspected or known significant flora and to confirm species recorded during the relevés for vegetation mapping. Specimens were identified by plant Taxonomist Dr Timothy Hammer using the appropriate taxonomic keys and, where required, relevant taxonomic experts at the Western Australian Herbarium were consulted.

Specimens are vouchered with the Western Australian Herbarium as per guidance; when they represent new populations of Threatened or Priority Flora, new occurrences of TECs or PECs, individuals that have atypical characteristics, or bioregional range extensions.

2.8.4. Limitations & Constraints

Survey specific limitations and constraints for the flora and vegetation assessment of the Study Areas are discussed in Table 2.9.

Table 2.9: Limitations & Constraints

Limitation	Constraint	Comment
Availability of contextual information at a regional and local scale.	No	There were several surveys identified in the Literature Review and available from the IBSA database in close proximity (20 km) to the study areas (see Table 2.4). These surveys gave excellent local and regional contextual information, particularly for conservation significance. For historical context, Beard mapping has been used, however this mapping is conducted at a coarse scale (1:250,000) and can only provide an approximate comparison.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	No	Botanist Chris Parker has ten years' experience in conducting botanical surveys throughout Western Australia, including experience within the Dampier Peninsula and Kimberly bioregion. Botanist Chris Shaw has 3 years' experience.
Restrictions to, or functionality of survey equipment and tools to complete the flora and vegetation assessment.	No	There were no restrictions to or compromised functionality of survey equipment or tools that would adversely affect the flora and vegetation equipment during the current survey.
Proportion of flora recorded and/or collected, any identification issues.	No/ Somewhat	Proportion of flora collected was consistent with expectations for this type of survey and survey timing in the context of other surveys of a similar level and seasonality. There was adequate floristic material available for the majority of the Priority Flora species listed with a high to low Likelihood of occurring within the Study Areas. The survey was conducted when these plants were expected to be flowering. The only exception was *Corymbia paractia* (P1) which was not flowering at the time of the survey and fruit was rarely present on trees. Without adequate floristic material *Corymbia paractia* is difficult to distinguish between other species, such as *Corymbia flavescens* which has a similar distribution. Plants were identified by taxonomist Tim Hammer who has botanical and taxonomic experience throughout Western Australia. Where there were complexities specialist taxonomists at the Western Australian herbarium were consulted. Thirteen specimens were unable to be confirmed or left with a query on their species confirmation due to poor quality material. This may also be contributed to the seasonal conditions for several specimens.
Survey effort and extent.	No	Prior to the field survey, quadrat sites were selected to represent the diversity of vegetation and geology present at the study area. This was sufficient to map and classify the vegetation of the study area for the Reconnaissance assessment. All the vegetation types identified are common for this area. The Study Area was adequately assessed in accordance with the Guidance Statement Guidelines
Access restrictions within the survey area.	No	There were no access limitations in the flora and vegetation survey.

Limitation	Constraint	Comment
Survey timing, rainfall, season of survey.	No	The field survey timing was considered appropriate season for a flora and vegetation survey conducted in the Kimberley Botanical Province. Despite surveying the sites when *Corymbia paractia* typically flowers (April – May) there was inadequate floristic material for the identification for many individuals.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No/ Somewhat	Large areas of the G1 Study Area were recorded as recently burnt. However; two quadrats were placed in unburnt areas that allowed adequate interpretation of flora and vegetation composition.

3. RESULTS

3.1. Flora

3.1.1. Desktop Assessment

Twenty significant flora taxa were recovered during the flora desktop assessment. One Threatened species, *Seringia exastia*, was assigned a Medium likelihood of occurring at the Site D2 due to its proximity (<10 km) and the possibility of suitable habitat occurring. *Seringia exastia* was given a Low probability of occurring at Site G1.

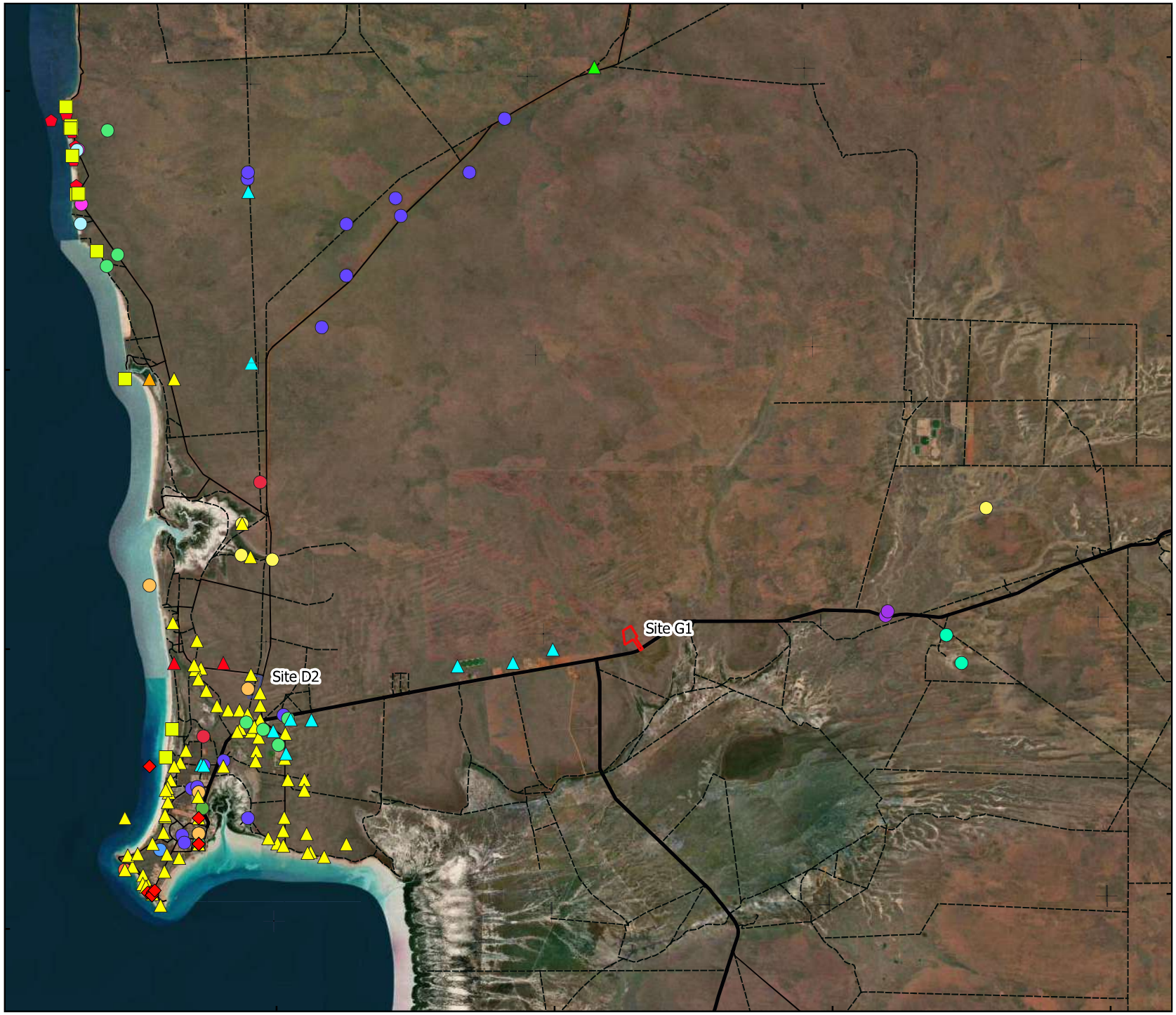
Corymbia paractia (Priority 1) was identified as Recorded within Site D2, with multiple individuals having been recorded along McGuigan Rd and Broome-Cape Leveque Rd by previous surveys. Five taxa have been assigned a High likelihood of occurrence at Site D2 due to the proximity of previous records and the occurrence of suitable habitat:

- *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (Priority 1);
- *Aphyllodium glossocarpum* (Priority 3);
- *Glycine pindanica* (Priority 3);
- *Polymeria* sp. Broome (K.F. Kenneally 9759) (Priority 3); and
- *Terminalia kumpaja* (Priority 3).

Jacquemontia sp. Broome (A.A. Mitchell 3028) was given a Medium likelihood of occurrence at Site G1 due proximity of previous records and suitable habitat occurring within. No significant taxa were assigned High likelihood of occurrence at Site G1. The likelihood of occurrence for all significant flora recorded during the desktop are listed in Table 3.1 and detailed in Appendix B. Records are mapped in Map 3.1

Table 3.1: Significant Flora – Desktop Assessment

Likelihood	Status	Species
Site D2		
Recorded	Priority 1	*Corymbia paractia*
High	Priority 1	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)
	Priority 3	*Aphyllodium glossocarpum*, *Glycine pindanica*, *Polymeria* sp. Broome (K.F. Kenneally 9759), *Terminalia kumpaja*
Medium	Threatened	*Seringia exastia*
	Priority 3	*Seringia katatona*, *Stylidium pindanicum*
Low	Priority 1	*Aphyllodium parvifolium*, *Ipomoea tolmerana* subsp. *occidentalis*, *Thespidium basiflorum*
	Priority 2	*Gomphrena pusilla*
	Priority 3	*Acacia monticola* x *tumida* var. *kulparn*, *Bonamia oblongifolia*, *Fuirena incrassata*, *Goodenia byrnesii*, *Lophostemon grandiflorus* subsp. *grandiflorus*, *Nymphoides beaglensis*
	Priority 4	*Pittosporum moluccanum*
Site G1		
Medium	Priority 1	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)
Low	Threatened	*Seringia exastia*
	Priority 1	*Aphyllodium parvifolium*, *Corymbia paractia*, *Ipomoea tolmerana* subsp. *occidentalis*, *Thespidium basiflorum*
	Priority 2	*Gomphrena pusilla*
	Priority 3	*Acacia monticola* x *tumida* var. *kulparn*, *Aphyllodium glossocarpum*, *Bonamia oblongifolia*, *Fuirena incrassata*, *Glycine pindanica*, *Goodenia byrnesii*, *Lophostemon grandiflorus* subsp. *grandiflorus*, *Nymphoides beaglensis*, *Polymeria* sp. Broome (K.F. Kenneally 9759), *Seringia katatona*, *Stylidium pindanicum*, *Terminalia kumpaja*
	Priority 4	*Pittosporum moluccanum*



Legend

Study Areas
- D2 Study Area
- G1 Study Area

Roads
- Minor Road
- Principal Road
- Track

Threatened Flora
- Seringia exastia

Priority 1 Flora
- Aphyllodium parvifolium
- Corymbia paractia
- Ipomoea tolmerana subsp. occidentalis
- Jacquemontia sp. Broome (A.A. Mitchell 3028)
- Thespidium basiflorum

Priority 2 Flora
- Gomphrena pusilla

Priority 3 Flora
- Acacia monticola x tumida var. kulparn
- Aphyllodium glossocarpum
- Bonamia oblongifolia
- Fuirena incrassata
- Glycine pindanica
- Goodenia byrnesii
- Lophostemon grandiflorus subsp. grandiflorus
- Nymphoides beaglensis
- Polymeria sp. Broome (K.F. Kenneally 9759)
- Seringia katatona
- Stylidium pindanicum
- Terminalia kumpaja

Priority 4 Flora
- Pittosporum moluccanum

N

0 5 10 km

Scale 1:400,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: TH

Date: 19-06-2020

Desktop Assessment Significant Flora Records

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map 3.1

3.1.2. Current Survey

A total of 127 taxa from 39 families and 93 genera were recorded during the survey. The most species rich family was Fabaceae, with 26 species from 14 genera recorded, followed by Poaceae with 16 species from 11 genera. The most species rich genus was *Acacia* with five species recorded. Of the 125 taxa recorded, three were significant flora and four were introduced species. The complete species list is presented in Appendix C.

3.1.2.1. Species Accumulation Curve

The species accumulation curve (SAC) is presented in Figure 3.1. The Chao 2 non-parametric species richness estimator indicated that 89.8% of flora species were recorded in the quadrats. The SAC was plotted using the *specaccum* function in the *vegan* package in R v.4. Appendix D lists the site by species matrix.

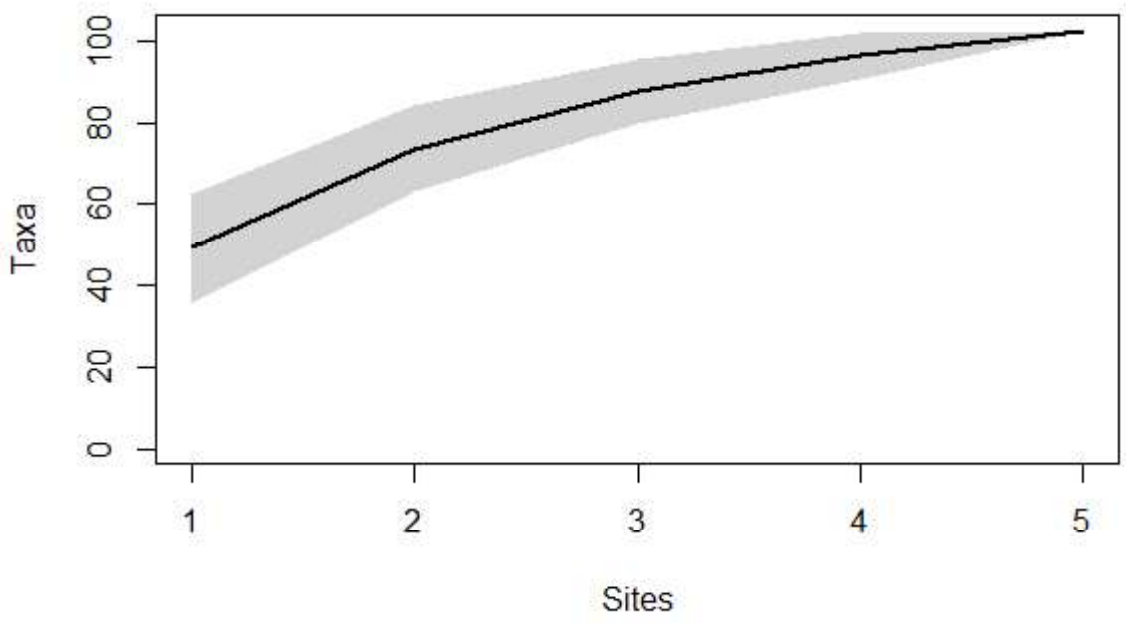


Figure 3.1: Species Accumulation Curve

3.1.2.2. Significant Flora

No Threatened Flora taxa were recorded within the Study Areas.

Three Priority Flora taxa were recorded within Site D2:

- *Corymbia paractia* (Priority 1);
- *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (Priority 1); and
- *Terminalia kumpaja* (Priority 3).

No Priority species were recorded from Site G1. *Sersalisia sericea*, a PEC indicator species, was recorded within both Study Areas. The Priority species recorded are outlined in Table 3.2 and mapped in Map 3.2 and Map 3.3.

Table 3.2: Significant Flora

	Taxon	Description	Study Area	# of Individuals		Photograph
P1	*Corymbia paractia*	Tree (often several-stemmed), 4-6(-12) m high, bark smooth, white, shedding in thin scales.	D2	14		
P1	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)	Perennial herb or subshrub with creeping habit. Flowers pink.	D2	715		
P3	*Terminalia kumpaja*	Small tree to 6 m, bark deeply fissured and corky.	D2	80		

Map images used with permission of the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (https: florabase.dpaw.wa.gov.au/help/copyright). Accessed on 15/06/2020.

Legend

- D2 Study Area

Detailed Flora Survey

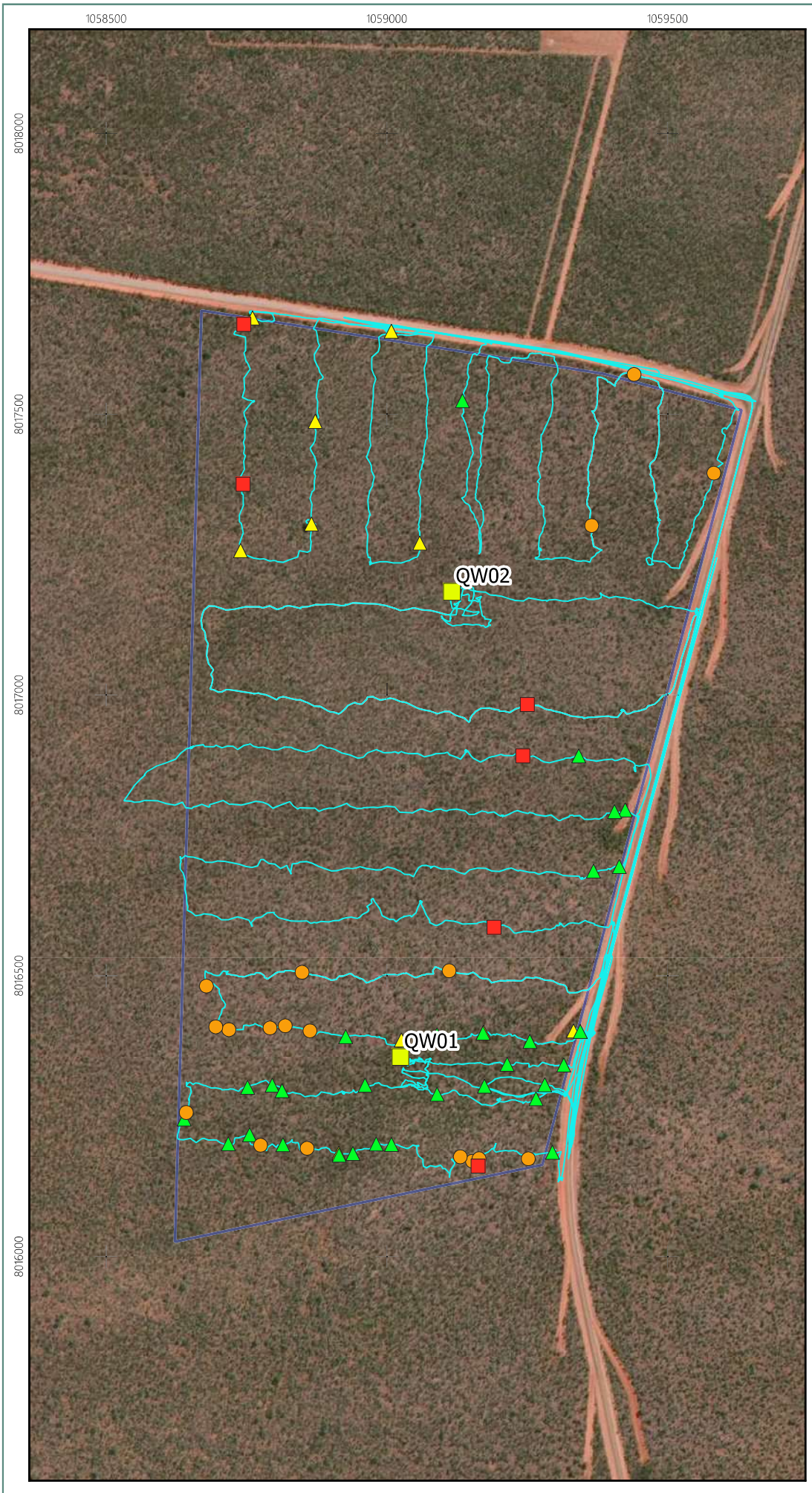
- Quadrat
- Site Traverse

Priority Flora

- Corymbia paractia (P1)
- Jacquemontia sp. Broome (P1)
- Terminalia kumpaja (P3)

PEC Indicator Species

- Sersalisia sericea



Spectrum ECOLOGY

Date: 19-06-2020

Author: TH

N

0 0.2 0.4 km

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Scale 1:10,000

D2 Study Area
Significant Flora Records

Broome Regional Resource Recovery Park

Map 3.2

Legend

- G1 Study Area

Detailed Flora Survey

- Quadrat
- Releve
- Site Traverse

PEC Indicator Species

- Sersalisia sericea

N

0 0.2 0.4 km

Scale 1:12,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: TH

Date: 19-06-2020

G1 Study Area Significant Flora Records

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map 3.3

3.1.2.3. Introduced Flora

Four introduced flora species were recorded from one quadrat and two relevé sites (Table 3.3). *Stylosanthes hamata* was the most common and was recorded at one relevé in G1 and seven opportunist collections in D2 and G1, especially near the roads. None of these species are Declared Pests in Western Australia. The records are mapped in Map 3.4.

Table 3.3: Introduced Flora Recorded at the Study Area

Family	Species	# of Individuals	Distribution	Environmental Significance
Poaceae	*?*Lolium perenne*	# of records: 2 # of plants: 4		Permitted – s11
Asteraceae	**Conyza bonariensis*	# of records: 1 # of plants: 1		Permitted – s11
Fabaceae	**Stylosanthes hamata*	# of records: 8 # of plants: 339		Permitted – s11
Fabaceae	**Stylosanthes scabra*	# of records: 1 # of plants: 3		Permitted – s11

Map images used with permission of the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (https: florabase.dpaw.wa.gov.au/help/copyright). Accessed on 15/06/2020.

Legend

- D2 Study Area
- G1 Study Area

Introduced Flora

- ?*Lolium perenne
- *Conyza bonariensis
- *Stylosanthes hamata
- *Stylosanthes scabra

N

0 2.5 5 km

Scale 1:170,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: TH

Date: 19-06-2020

Introduced Flora

Broome Regional Resource Recovery Park

Map 3.4

Prepared for
Talis | Broome Shire

3.2. Vegetation

3.2.1. TEC & PEC Communities

Twelve ecosystems of conservation significance, consisting of 118 records, were identified from the database search and are listed in Table 3.4 and mapped in Map 3.5.

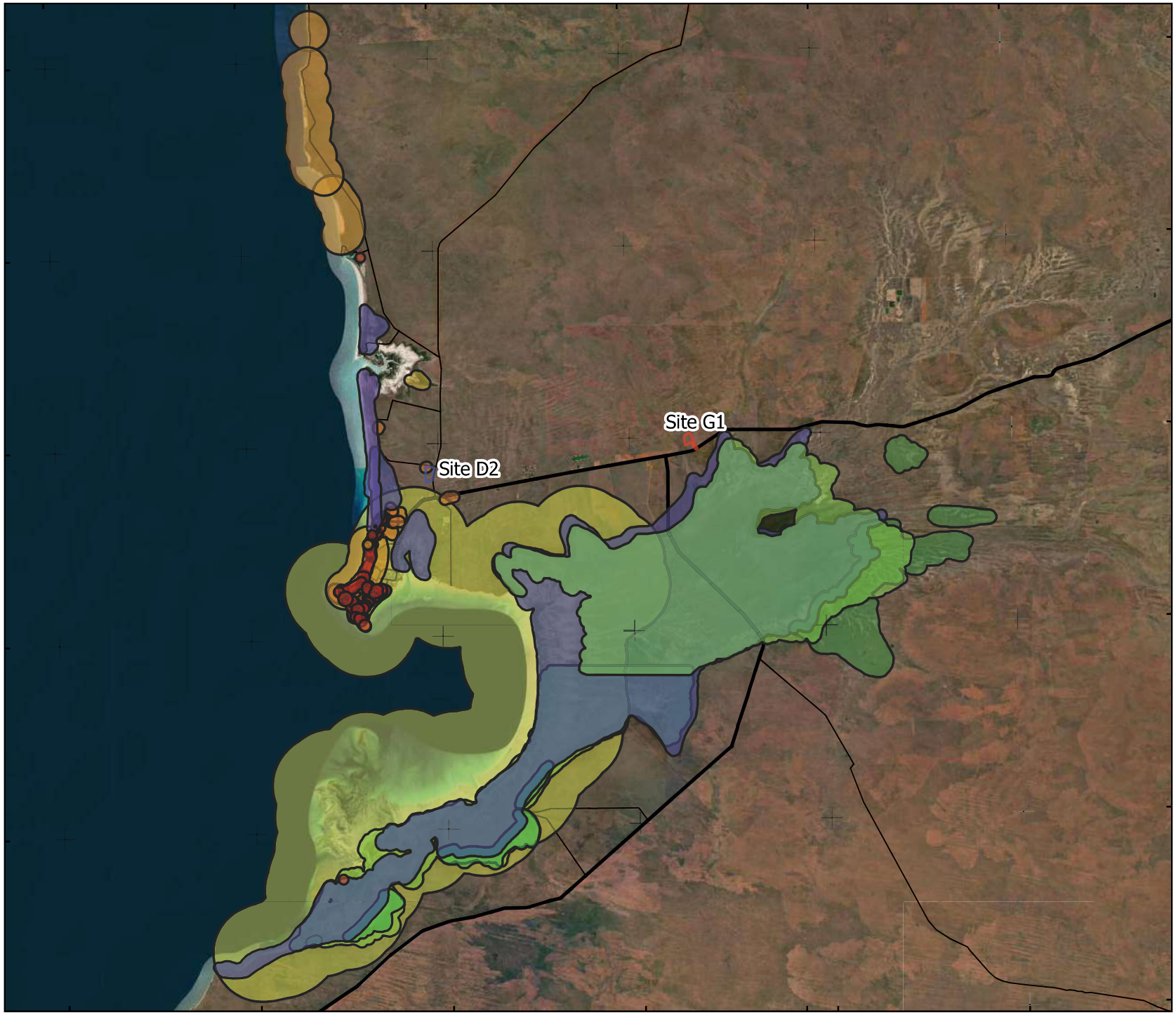
One floristic Threatened Ecological Community (TECs) occurs within 50 km of the Study Areas (Table 3.4). The Monsoon Thickets TEC is listed as Vulnerable and restricted to coastal sand dunes. The Study Areas have a low likelihood of containing the Monsoon Thickets TEC as they are mapped on different geological and vegetation units.

Four Priority 1 Priority Ecological Communities (PECs) were recorded within 50 km of the Study Areas (Table 3.4). The Mangarr (Minyjuru) P1 PEC was recorded within the north-west corner of the D2 Study Area (Map 3.5). The *Corymbia paractia* P1 PEC was classified as a high likelihood of occurring within the D2 Study area due to their proximity to the PEC and potential for suitable habitat within the Study Areas. The Dwarf Pindan Heath P1 PEC and Vegetation Association 770 P1 PEC were classified as low likelihood of occurring within the Study Areas due to their location and vegetation description.

Five Priority 3 and one Priority 4 PECs occurred within 50 km of the Study Areas (Table 3.4). The Vegetation Association 73 P3 PEC was classified as a medium likelihood of occurring within both Study Areas due to their close proximity to the PEC buffer (Map 3.5).

Table 3.4: TEC & PEC Desktop Assessment

Likelihood		Status	PEC	Description	Distance from Project
D2	G1				
Low	Low	Vulnerable / Endangered TEC	Monsoon Thickets	Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula.	D2 – 5.9 km SE G1 – 32.7 km SE
Low	Low	Vulnerable TEC	Roebuck Bay Mudflats	Species-rich faunal community of the intertidal mudflats of Roebuck Bay.	D2 – 0.6 km S G1 – 8.6 km SE
High	Low	PEC P1	*Corymbia paractia*	*Corymbia paractia* dominated community on dunes.	D2 – 5.2 km SE G1 – 31.8 km E
Low	Low		Dwarf Pindan Heath	Dwarf pindan heath community of Broome coast.	D2 – 14.0 km SE G1 – 38.0 km SE
Recorded	Low		Mangarr (Minyjuru)	Relict dune system dominated by extensive stands of Minyjuru (Mangarr - *Sersalisia sericea*).	D2 – Within buffer G1 – 24.1 km E
Low	Low		Vegetation Association 770	Shrublands; Wattle thicket near Broome.	D2 – 4.9 km E G1 – 31.8 km E
Low	Low	PEC P3	Eighty Mile Land System	Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands.	D2 – 41.7 km S G1 – 57.2 km SE
Low	Low		Roebuck Land System	Paleo-tidal coastal plains and tidal flats with saline soil supporting salt-water couch grasslands, samphire low shrublands, melaleuca thickets and mangroves.	D2 – 10.1 km SW G1 – 2.1 km SW
Low	Low		Vegetation Association 37	Shrublands; teatree thicket.	D2 – 31 km SW G1 – 35 km SE
Low	Low		Vegetation Association 67	Grasslands, tall bunch grass savanna, sparse low tree; ribbon grass & paperbarks.	D2 – 39.9 km SE G1 – 19.6 km E
Medium	Medium		Vegetation Association 73	Grasslands, short bunch grass savanna, grass; salt water grassland (*Sporobolus virginicus*).	D2 – 3.1 km W G1 – 1.7 km SE
Low	Low	PEC P4	Nimalarica Claypan	Nimalaica claypan is a unique, almost permanent, freshwater lake inland from Willie Creek, Broome.	D2 – 7.9 km N G1 – 26.9 km NE



Legend

D2 Study Area

G1 Study Area

TEC-PEC

- Corymbia paractia
- Dwarf pindan heath
- Eighty Mile Land System
- Mangarr (Minyjuru)
- Monsoon thickets
- Nimalarica Claypan
- Roebuck Bay mudflats
- Roebuck Land System
- Vegetation Association 37
- Vegetation Association 67
- Vegetation Association 73
- Vegetation Association 770

Roads

- Principal Road
- Minor Road

N

0 5 10 15 20 km

Scale 1:580,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 19-06-2020

TEC & PEC Search Results

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map 3.5

3.2.2. Vegetation Types

Two vegetation types were recorded; however, only one vegetation type was recorded within the Study Areas. The two vegetation types are described in Table 3.5. The vegetation types at the D2 and G1 Study Areas are presented in Map 3.6 and Map 3.7, respectively. The dendrogram is presented in Figure 3.2. Two clusters containing QW01 and QW03 and QW02 and QW04 were identified in the dendrogram but were not given separate vegetation units due to the short distance or low dissimilarity (dissimilarity = 0.49) between clusters (Figure 3.2). Furthermore, the similarity in the vegetation between the two clusters was confirmed by comparing the dominant species. Site descriptions are presented in Appendix E.

Table 3.5: Vegetation Types

Unit	Description	Associated Species (Priority Species in Bold)	Quadrats	Area (ha)	Representative Photo
V001	*Corymbia greeniana low open woodland* with *Acacia eriopoda* and *Bauhinia cunninghamii* tall open shrubland, over *Triodia schinzii* and *Triodia caelestialis* low sparse hummock grassland and *Chrysopogon pallidus* and *Sorghum plumosum* low sparse tussock grassland.	*Acacia colei* var. *colei* *Aristida hygrometrica* *Corymbia zygophylla* *Grewia pindanica* ***Corymbia paractia*** ***Jacquemontia* sp. Broome (A.A. Mitchell 3028)** ***Terminalia kumpaja***	QW01 QW02 QW03 QW04	220	
V002	*Brachychiton diversifolius* subsp. *diversifolius* low open woodland over, *Atalaya hemiglauca*, *Codonocarpus cotinifolius*, and *Grewia pindanica* mid sparse shrubland, over *Aristida holathera* var. latifolia sparse tussock grassland.	*Acacia platycarpa* *Bauhinia cunninghamii* *Triodia schinzii*	QW05	0	

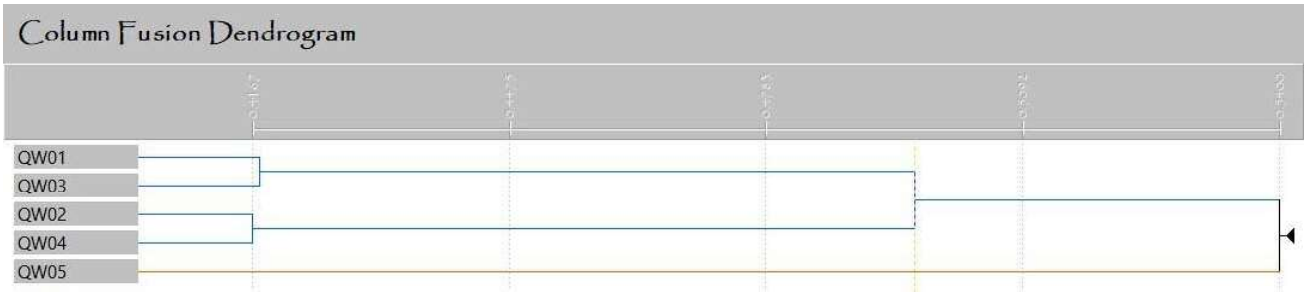


Figure 3.2: Dendrogram of Floristic Analysis

3.2.3. Vegetation Condition

The two Study Areas were mapped as having Excellent (100%) vegetation condition. Weeds were rarely recorded in the Study Areas Map 3.4.

Legend

- D2 Study Area

Detailed Flora Survey

- Quadrat

Reconnaissance Flora Survey

- Releve

Vegetation Units

- V001

Spectrum ECOLOGY

Date: 19-06-2020

Author: CS

N

0 0.2 0.4 km

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Scale 1:10,000

D2 Study Area
Vegetation Mapping

Broome Regional Resource Recovery Park

Map
3.6

Legend

- G1 Study Area

Detailed Flora Survey

- Quadrat
- Releve

Reconnaissance Flora Survey

- Releve

Vegetation Units

- V001

N

0 0.2 0.4 km

Scale 1:12,000 @ A4

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum ECOLOGY

Author: CS

Date: 19-06-2020

G1 Study Area Vegetation Mapping

Broome Regional Resource Recovery Park

Prepared for
Talis | Broome Shire

Map 3.7

4. DISCUSSION

4.1. Threatened Flora

No Threatened Flora taxa were recorded in the current survey or considered likely to occur.

One Threatened Flora taxon was recorded during the desktop assessment, *Seringia exastia,* located 9 km south-west of Site D2 and 33 km south-west of Site G1.

4.1.1. Local & Regional Significance

There were three significant flora taxa recorded from Site D2, *Corymbia paractia* (Priority 1), *Terminalia kumpaja, and Jacquemontia* sp. Broome (A.A. Mitchell 3028). Other significant flora taxa assessed in the desktop were thoroughly searched for but were not found.

Corymbia paractia (Priority 1) was confirmed to occur in Site D2, where it was Recorded in the desktop assessment. Site D2 is within the modelled distribution of the species that was performed by Environs Kimberley (2018). A previous record of *Terminalia kumpaja* (Priority 3) was within 40 m of the Site D2, and it was recorded as occurring from Site D2 at 18 new locations. Thirty-one new locations of *Jacquemontia* sp. Broome (A.A. Mitchell 3028) were recorded from Site D2.

The three Priority taxa recorded from Site D2 were assigned a Low local and regional significance. This is in addition to *Glycine pindanica* (Priority 3) that was given a High likelihood of occurring in Site D2 during the desktop assessment, but which was not recorded during the survey. These taxa are locally common around the Broome area, as well as being known from additional records in the region that were outside of the 50 km database search radius.

Aphyllodium glossocarpum (Priority 3) was also assigned a High likelihood of occurring at Site D2 in the desktop assessment. This species was ranked as having a High local significance if it were to be found at the Study Area, as it is known from only two previous records around Broome, which was it was reported as the sole individual when collected. Given the effort of the current survey, it is unlikely that this species occurs within either Study Area. While maybe rare or under-collected in the Broome area, the species is known from records north to Dampier Peninsula and in the Shire of Wyndham-East Kimberley, and for this reason is considered to have a Low regional significance.

Table 4.1: Priority Flora of Local & Regional Significance

Taxa	Recorded in Survey	Desktop Likelihood	Local Significance		Regional Significance	
Priority 1						
Corymbia paractia	Yes	Recorded (D2) Low (G1)	Locally common in the near-coastal areas around Broome.	Low	Recorded from the Dampierland IBRA region, from Broome townsite to Coulomb Point Nature Reserve. An outlying record exists north of Camballin.	Low
Jacquemontia sp. Broome (A.A. Mitchell 3028)	Yes	High (D2) Medium (G1)	Known from several previous locations in the vicinity of Broome.	Low	Recorded from the Dampierland IBRA region, with most records around Broome townsite.	Low
Priority 3						
Aphyllodium glossocarpum	No	High (D2) Low (G1)	Known from two records in the local area, where it was recorded as rare.	High	Known from records from Broome townsite to Shire of Wyndham-East Kimberley.	Low
Glycine pindanica	No	High (D2) Low (G1)	Many records in the local area. Recorded on a widespread landform type that is not restricted.	Low	Recorded from the Dampierland IBRA region from Broome townsite to the Dampier Peninsula.	Low
Terminalia kumpaja	Yes	High (D2) Low (G1)	Known from several previous locations in the vicinity of Broome.	Low	Recorded from the Dampierland and Great Sandy Desert IBRA regions. More common and widespread in the vicinity of Eighty Mile Beach.	Low

4.2. Vegetation

4.2.1. Vegetation Resembling TEC/PEC

Two TECs and ten PECs were recorded within 50 km of the Study Areas and of these the Mangarr (Minyjuru) PEC was recorded within the D2 Study Area in the desktop assessment (Map 3.5) and the *Corymbia paractia* PEC was assigned a high likelihood of occurrence within the D2 Study Area.

The Mangarr PEC "contains frequent mature (100 years +) *Sersalisia sericea* or otherwise known as Minyjuru" and occurs on parallel dunes in the area south east of Gantheaume Point (DBCA, 2020). Stands of *Sersalisia sericea* (Minyjuru) occur in association with the Monsoon vine thicket TEC (DBCA, 2020). Woodland and desert/aridlands plant species associated with Mangarr PEC and records of these plant species during the detailed flora survey are presented in Table 4.2.

Table 4.2: Mangarr (Minyjuru) PEC *Sersalisia sericea* & Associated Plant Species

Associated Taxa	D2 Records			G1 Records		
	QW01 Cover %	QW02 Cover %	Opportunistic Count #	QW03 Cover %	QW04 Cover %	Opportunistic Count #
Sersalisia sericea	-	-	10	-	-	1
Corymbia zygophylla	1.0	-	1	-	0.2	-
Corynotheca micrantha	-	-	-	-	-	-
Erythrophleum chlorostachys	-	-	-	-	-	-
Goodenia sepalosa	0.01	0.01	-	0.01	-	-
Gyrostemon tepperi	0.1	-	-	-	-	-
Hakea macrocarpa	-	-	-	-	0.01	-
Scaevola parvifolia	-	-	-	-	-	1
Senna costata	-	0.01	-	0.25	-	-
Solanum cunninghamii	-	-	-	-	-	-
Triodia species	25	17	-	3	5	-

Ten *Sersalisia sericea* trees were identified at six locations within the D2 Study Area (Table 4.2; Map 3.2). Four *Sersalisia sericea* trees occurred within the existing PEC at D2 and were likely recorded by Willing & Beames (2015) during the mapping and condition assessment of the Mangarr PEC. Six *Sersalisia sericea* trees were located 200–250 m from the D2 Study Area's eastern boundary (Map 3.2). Three of these *Sersalisia sericea* trees were located outside the PEC but within the D2 Study Area and were recorded by Willing & Beames (2015). Willing & Beames (2015) did not classify this small cluster of trees as a Mangarr PEC as they exist outside defined patches due to historical clearing and the degradation of vegetation. It is unlikely the *Sersalisia sericea* trees recorded outside the existing Mangarr PEC but within the D2 Study Area represent the PEC based on previous mapping of its distribution by Willing & Beames (2015). Willing & Beames (2015) suggested the outlier *Sersalisia sericea* trees be protected from clearing.

A single *Sersalisia sericea* tree was recorded at the G1 Study Area (Table 4.2). The individual *Sersalisia sericea* tree recorded at the G1 Study Area does not represent the Mangarr PEC as there were no frequent mature individuals recorded in the detailed flora survey (Table 4.2).

The *Corymbia paractia* PEC is described as "*Corymbia paractia* dominated community on dunes" (DBCA, 2020). The current *Corymbia paractia* PEC occurs in the Broome township area, and the PEC may occur in the transition zone between coastal vine thickets and Pindan vegetation (DBCA, 2020). The D2 Study Area

is located in the transition zone between coastal vine thickets and Pindan vegetation (see Section 1.5). Distribution modelling of *Corymbia paractia* indicates the species is common in vegetation surrounding Broome, including the D2 Study Area (Environs Kimberley, 2018). *Corymbia paractia* was extensively recorded at the D2 Study Area along tracks (Environs Kimberley, 2018). *Corymbia paractia* was recorded 10 times (13 individuals) within the D2 Study Area (Map 3.1; Map 3.2). The D2 Study Area likely contains the *Corymbia paractia* PEC given the distribution of the species, abundance of the species, the presence of associated vegetation, and existing protections placed on individuals in the township of Broome.

4.2.2. Local & Regional Significance

Regional significance was determined by comparing the vegetation units of the Project with the pre-European vegetation association mapping undertaken by Beard (DPIRD, 2019; see Section 1.5) to determine potential regional extent. Local significance was determined using the other definitions for significant vegetation (Section 2.4); whether it plays a role as refuge, has a degree of historical impact from threatening processes or maintains integrity of a significant ecosystem.

The Beard vegetation unit associated with the two Study Areas has a wide distribution throughout the Dampierland IBRA region. The Study Areas represent a small fraction of the Yeeda and Wanganut Land Systems which are widespread across the Dampierland IBRA region and Western Australia. The V001 vegetation type mapped at both Study Areas have a low regional significance.

The V001 vegetation unit mapped at both Study Areas is considered to have a low significance. The D2 Study Area overlaps with a Mangarr PEC and likely contains the *Corymbia paractia* PEC; however, these PECs are not locally restricted. The V001 vegetation unit provides refuge to three significant flora, these three species recorded at the D2 study Area are locally and regionally widespread.

4.3. Principles for Clearing Native Vegetation

An assessment on how the proposed vegetation clearing applies to the native vegetation clearing principles is present below in Table 4.3

Table 4.3: 10 Native Vegetation Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	It comprises a high level of biological diversity.	There was one vegetation type identified from the Study Areas derived from flat Pindan Plains. There were 127 taxa from 39 families and 93 genera were recorded during the survey. The proportion of flora collected was consistent with expectations for this type of survey and survey timing in the context of other surveys of a similar level and seasonality. Both Study Areas fall in the 750.1 Pre-European Vegetation mapping classification. This vegetation unit covers more than 1.2 million hectares, of which, approximately 99% is undisturbed. There were 31 and 38 vertebrate fauna species found within the D2 and G1 Study Areas, respectively. Given the species count, vegetation types, literature review and the Pre-European vegetation units, the vegetation at the Study Areas is not considered to have a high level of biological diversity.	The Proposal at the Study Areas is not likely to be at variance to this Principle.
(b)	It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	The Pindan shrubland habitat that occurs in the Study Areas is homogenous and the microhabitats present are not thought likely to support short range endemic invertebrate species. Overall, the Pindan Shrubland habitat recorded from within the Study Areas occurs across a large continuous extend across the Dampier Peninsula, which indicates that there is a low likelihood that the habitat within the Study Areas supports any taxa with a distribution restricted to either Study Area.	The Proposal at the Study Areas is not likely to be at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
(c)	It includes, or is necessary for the continued existence of, rare flora.	No Threatened Flora were recorded in the reconnaissance or detailed survey at the D2 and G1 Study Areas. One Threatened Flora species *Seringia exastia* was identified in the database searches. This species was considered to have a medium likelihood of occurrence at D2 and a low likelihood of occurrence at G1. *Seringia exastia* was not recorded during the exhaustive detailed and targeted assessment. Three Priority Flora, *Corymbia paractia* (P1), *Jacquemontia* sp. Broome (P1), and *Terminalia kumpaja* (P3) were recorded within the D2 Study Area. Nineteen Priority Flora were recorded in the desktop assessment, *Aphyllodium glossocarpum* (P3), *Glycine pindanica* (P3), and *Polymeria* sp. Broome (P3) were considered to have a high likelihood of occurrence in the D2 Study Area. Although the D2 Study Area includes conservation significant flora and has appropriate habitat for conservation significant flora, clearing of the D2 Study Area is unlikely to threaten the continued existence of the recorded Priority Flora and other Priority Flora with High Likelihood of occurrence. Vegetation at the D2 Study Area is not necessary for the continued existence of this conservation significant flora. The disturbance footprint within the D2 Study Area can be located in an area that avoids recorded conservation significant flora. No Priority Flora were recorded at the G1 Study Area. Although the G1 Study Area has appropriate habitat for conservation significant flora, clearing of the G1 Study Area is unlikely to threaten the continued existence of these Priority Flora.	The Proposal at the D2 Study Area is not likely to be at variance to this Principle. The Proposal at the G1 Study Area is not likely to be at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
(d)	It comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	No Threatened Ecological Communities were recorded within the D2 and G1 Study Areas. One federally listed TEC (State listed Vulnerable) was identified from the database searches, Monsoon vine thicket. An additional State listed, Vulnerable Ecological Community, Roebuck Bay mudflats was identified form the database searches. These ecological communities are associated with riparian vegetation and do not resemble any vegetation communities of the Study Areas. The buffers of two P1 Priority Ecological Communities (PEC) were recorded in the D2 Study Area during the database searches. The Mangarr (Minyjuru) PEC is described as "relict dune system dominated by extensive stands of Minyjuru (Mangarr - *Sersalisia sericea*)". The Mangarr PEC was previously recorded in the north-west corner of the D2 Study Area. During the survey, *Sersalisia sericea* trees were targeted during the 100 m spaced traverses and six trees were recorded outside the current PEC boundary in the north-west corner; however, it is unlikely these trees represent the Mangarr PEC based on previous surveys of the Study Area. The *Corymbia paractia* PEC is described as "*Corymbia paractia* dominated community on dunes". The D2 Study Area vegetation can be described as "transition zone between coastal vine thickets and Pindan vegetation" which is where the *Corymbia paractia* PEC occurs. *Corymbia paractia* trees were recorded within the D2 Study Area. The D2 Study Area likely contains the *Corymbia paractia* PEC given the distribution of the species in the surrounding area, abundance of the species, the presence of associated vegetation, and existing protections placed on individuals in the township of Broome. The disturbance footprint within the D2 Study Area can be located in an area that avoids the *Corymbia paractia* trees that likely represent the *Corymbia paractia* PEC. No PECs or TECs were recorded from the G1 Study Area. Three PECs are within 10 km to the south of the G1 Study Area. Each of these PECs are associated with riparian communities and do not occur at the G1 Study Area. Native vegetation at the G1 Study Area does not comprise the whole or part of, or is necessary for the maintenance of a TEC.	The Proposal at the D2 Study Area is somewhat at variance to this Principle. The Proposal at the G1 Study Area is not likely to be at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
(e)	It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The Study Areas are 100% comprised of the 750.1 Beard vegetation unit. The vegetation unit is widespread and 99.7% of its pre-European extent remains. The Study Areas represent a small fraction of the vegetation unit. The vegetation at the Study Areas is not significant as the vegetation unit has not been extensively cleared.	The Proposal at the Study Areas is not likely to be at variance to this Principle.
(f)	It is growing in, or in association with, an environment associated with a watercourse or wetland.	No nationally significant wetlands, including Ramsar wetlands or watercourses were located within the Study Areas. The D2 Study Area occurs 1 km north of the buffer surrounding the Roebuck bay Mudflats; Species-rich faunal community of the intertidal mudflats of Roebuck Bay.	The Proposal at the Study Areas is not likely to be at variance to this Principle.
(g)	The clearing of the vegetation is likely to cause appreciable land degradation.	The total area to be cleared at the D2 Study Area is 2.5 ha. The Total area to be cleared at the G1 Study Area is 3.0 ha. Considering the small area proposed to be cleared, the history of minimal land clearing in the area and existing vegetation condition of the Study Area, it is unlikely that the proposed clearing will cause appreciable land degradation.	The Proposal at the Study Areas is not likely to be at variance to this Principle.
(h)	The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	One conservation area, Yawuru Birragun Conservation Park (WA_52354) is adjacent and directly west of the D2 Study Area. Clearing of approximately 2.5 ha to establish temporary tracks, bore holes and trial pits at the D2 Study Area is unlikely to impact the environmental values of this area. No conservation areas are within the vicinity of the G1 Study Area as defined by the Land Management Act (1984) as National Parks, Nature Reserves, Conservation Reserve or other areas managed for biodiversity conservation. The clearing of vegetation (3.0 ha) in the G1 Study Area is not considered to impact on the environmental values of any adjacent or nearby conservation area.	The Proposal at the Study Areas is not likely to be at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
(i)	The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The proposed clearing of native vegetation at D2 (2.5 ha) and G1 (3.0 ha) to establish temporary tracks, bore holes and trial pits at the Study Areas is not expected to cause deterioration in the quality of surface or underground water. Further site investigation works including hydrological surveys will provide more information as the project matures.	The Proposal at the Study Areas is not likely to be at variance to this Principle.
(j)	The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The remnant vegetation proposed to be cleared at the D2 and G1 Study Areas is 2.5 ha and 3.0 ha, respectively. These areas are small and are not expected to cause or exacerbate the instance of flooding.	The Proposal at the Study Areas is not likely to be at variance to this Principle.

5. CONCLUSION

5.1. Threatened Flora

No Threatened Flora have previously been recorded within the Study Areas. One Threatened Flora taxon was assigned a medium likelihood of occurrence, *Seringia exastia*, but was not found in the current survey.

5.2. Significant Flora

A total of three Priority Flora taxa have been recorded within the Study Areas:

- *Corymbia paractia* (Priority 1);
- *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (Priority 1); and
- *Terminalia kumpaja* (Priority 3).

All Priority Flora taxa recorded in the Study Areas were assessed to have Low local and regional significance.

5.3. Vegetation

Twelve ecosystems of conservation significance were recorded in the vicinity of the Study Areas.

The Desktop Assessment found the Mangarr (Minyjuru) (P1) Priority Ecological Community was present in north-west corner of the D2 Study Area. Scattered *Sersalisia sericea* (Minyjuru) trees were recorded in the D2 Study Area but were unlikely to indicate the presence of the Mangarr PEC based on previous surveys.

The *Corymbia paractia* P1 PEC is likely to occur within the D2 Study Area based on the known distribution of *C. paractia*, the abundance of the species, and the presence of associated vegetation. TEC or PECs are not likely to occur within the G1 Study Areas.

One vegetation unit (V001) was mapped at the three Study Areas. The vegetation unit is not likely to have local and regional significance.

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Appendix A: Conservation Codes

Appendix A1: Definitions of Conservation Categories under the EPBC Act

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

Appendix A2: Definitions of Conservation Categories under the BC Act (DBCA 2019)

Threatened Species: Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as Threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

Threatened fauna s that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened Flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Definition
CR	**Critically endangered species** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered species** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable species** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species: Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

Category	Definition
EX	**Extinct species** Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	**Extinct in the wild species** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere

	in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no Threatened fauna or Threatened Flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species: Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under **schedule 5** of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (Conservation dependant fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under **schedule 6** of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under **schedule 7** of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
[1] The definition of flora includes algae, fungi and lichens. [2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Appendix A3: Definitions of Priority Species Classification (DBCA 2019)

Priority species: Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of Priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora.

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. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Definition
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy

Appendix A4: Legal Status Definition of Listed Plants in Western Australia

Legal Status	Definition
Declared Pest, Prohibited – s12	Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
Declared Pest – s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to control keeping requirements.
Permitted – s11	Permitted organisms must satisfy applicable import requirements and import permits (where required).
Permitted, Requires Permit – r73	Regulation 73 permitted organisms may be subject to restriction under legislation other than the BAM Act (2007).
Unlisted	Unlisted organisms are prohibited in WA.
Control Categories	**Definition**
C1 Exclusion	Organisms should be excluded from parts or all of WA.
C2 Eradication	Organisms should be eradicated from all or parts of WA.
C3 Management	Organisms should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Declared pest that are recognised as having a harmful impact under certain circumstances where their subsequent control requirements are determined by a plan or other legislative arrangements under the Act.
Keeping Categories	**Definition**
Prohibited keeping	Can only be kept under a permit for public display, education or scientific purposes.
Restricted keeping	Kept under a permit by private individuals due to a low risk of becoming a problem for the environment.
Exempt keeping	No permit or conditions are required for keeping. Organism may be subject to restrictions under the Wildlife Conservation Act (WCA, 1950).

Appendix B: Flora Desktop Assessment

Status	Family	Taxon	Description	Habitat	Closest Record to D2 (km)	Closest Record to G1 (km)	Likelihood (D2)	Likelihood (G1)
P3	Fabaceae	*Acacia monticola* x *tumida* var. *kulparn*	Low shrub. Hybrid of *Acacia monticola* and *A. tumida* var. *kulparn*.	Coastal cliffs.	10	33	Low	Low
P3	Fabaceae	*Aphyllodium glossocarpum*	Spreading or erect shrub, to 1.2 m high. Flowers pink-purple.	Sand. Pindan.	4	28	High	Low
P1	Fabaceae	*Aphyllodium parvifolium*	Trailing shrub, to 0.3 m high. Flowers purple-pink.	Sand. Sandhills.	22	38	Low	Low
P3	Convolvulaceae	*Bonamia oblongifolia*	Perennial herb or shrub. Flowers blue.	Sandy or gravelly soils.	36	50	Low	Low
P1	Myrtaceae	*Corymbia paractia*	Tree 4-6(-12) m high, bark smooth, white, shedding in thin scales. Flowers white.	Skeletal soils. In transition zone between coastal beach dunes & red pindan soils.	0	24	Recorded	Low
P3	Cyperaceae	*Fuirena incrassata*	Annual sedge 0.1-0.3 m high, perianth of 3 bristles and 3 clawed scales; scales 3-veined in basal part and thickened distally.	Sand, sandy clay. Swamps, creek beds, claypans, semi-saline lakes.	45	18	Low	Low
P3	Fabaceae	*Glycine pindanica*	Prostrate or scrambling perennial, herb or climber. Flowers pink/blue-purple.	Pindan soils.	2	25	High	Low
P2	Amaranthaceae	*Gomphrena pusilla*	Slender branching annual herb, to 0.2 m high. Flowers white.	Fine beach sand. Behind foredune, on limestone.	6	33	Low	Low
P3	Goodeniaceae	*Goodenia byrnesii*	Prostrate to decumbent herb, stems to 30 cm. Flowers yellow.	Sand. Edge of creek.	13	36	Low	Low
P1	Convolvulaceae	*Ipomoea tolmerana* subsp. *occidentalis*	Perennial vine with mid mauve flowers, growing up to 1 m tall.	Red pindan plain.	49	39	Low	Low
P1	Convolvulaceae	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)	Perennial herb or subshrub. Flowers pink.	Red pindan plain.	1	5	High	Medium
P3	Myrtaceae	*Lophostemon grandiflorus* subsp. *grandiflorus*	Tree 4-8 m high. Flowers cream-white.	Damp habitats (swamps, seepages).	34	49	Low	Low
P3	Menyanthaceae	*Nymphoides beaglensis*	Aquatic annual herb. Flowers white/white-pink-purple.	Edges of permanent waterholes or in seasonally inundated claypans & depressions.	22	49	Low	Low

Status	Family	Taxon	Description	Habitat	Closest Record to D2 (km)	Closest Record to G1 (km)	Likelihood (D2)	Likelihood (G1)
P4	Pittosporaceae	*Pittosporum moluccanum*	Tree 2-6 m high. Flower white.	White sand. Sand dunes.	37	50	Low	Low
P3	Convolvulaceae	*Polymeria* sp. Broome (K.F. Kenneally 9759)	Perennial herb or subshrub. Flowers pink.	Red pindan plain.	2	23	High	Low
T	Malvaceae	*Seringia exastia*	Erect compact multi-stemmed shrub to 0.9 m high. Flowers purple.	Red pindan plain.	9	33	Medium	Low
P3	Malvaceae	*Seringia katatona*	Shrub. Flowers mauve.	Red sand.	8	33	Medium	Low
P3	Stylidiaceae	*Stylidium pindanicum*	Annual herb to 20 cm. Flowers pink.	Clay soil. Open woodland over grassland.	8	26	Medium	Low
P3	Combretaceae	*Terminalia kumpaja*	Small tree to 6 m tall. Bark deeply furrowed and corky.	Red pindan plain.	0.04	27	High	Low
P1	Asteraceae	*Thespidium basiflorum*	Densely tufted perennial herb to 0.2 m high. Flowers green.	Sandy soils. Creeks.	2	29	Low	Low

Appendix C: Species List

Family	Taxon	Comment & Significance
Aizoaceae	*Trianthema pilosum*	-
Amaranthaceae	*Ptilotus exaltatus*	-
	Ptilotus lanatus	-
	Ptilotus polystachyus	-
Apocynaceae	*Carissa lanceolata*	-
	Marsdenia viridiflora subsp. *tropica*	-
Araliaceae	*Trachymene oleracea*	-
Asteraceae	*Conyza bonariensis*	Weed
	Pterocaulon intermedium	-
	Pterocaulon serrulatum var. *velutinum*	-
Bignoniaceae	*Dolichandrone occidentalis*	-
	Ehretia saligna var. *saligna*	-
Boraginaceae	*Heliotropium leptaleum*	-
	Heliotropium ovalifolium	-
	Trichodesma zeylanicum	-
Byblidaceae	*Byblis filifolia*	-
Caryophyllaceae	*Polycarpaea longiflora*	-
Celastraceae	*Stackhousia intermedia*	-
Cleomaceae	*Cleome tetrandra* var. *tetrandra*	-
Combretaceae	*Terminalia ferdinandiana*	-
	Terminalia hadleyana	-
	Terminalia kumpaja	Priority 3
Commelinaceae	*Murdannia graminea*	-
Convolvulaceae	*Bonamia ?media*	Sterile
	Evolvulus alsinoides var. *decumbens*	-
	Ipomoea sp.	Sterile
	Jacquemontia sp. Broome (A.A. Mitchell 3028)	Priority 1
	Operculina aequisepala	-
Cucurbitaceae	*Cucumis variabilis*	-
Cyperaceae	*Bulbostylis barbata*	-
	Cyperus conicus	-
	Fimbristylis oxystachya	-
	Scleria brownii	-
Euphorbiaceae	*Euphorbia coghlanii*	-
	Euphorbiaceae sp.	Sterile
Fabaceae	*Acacia adoxa* var. *subglabra*	-
	Acacia colei var. *colei*	-
	Acacia eriopoda	-
	Acacia platycarpa	-
	Acacia tumida var. *tumida*	-
	Bauhinia cunninghamii	-
	Cajanus marmoratus	-
	Chamaecrista moorei	-
	Crotalaria cunninghamii	-
	Crotalaria medicaginea var. *neglecta*	-
	Crotalaria ramosissima	-
	Cullen corallum	-
	Fabaceae sp.	Sterile
	Glycine tomentella	-
	Indigofera colutea	-
	Indigofera linifolia	-
	Jacksonia aculeata	-
	Rhynchosia minima	-
	Senna costata	-
	Senna notabilis	-
	Stylosanthes hamata	Weed
	Stylosanthes scabra	Weed

Family	Taxon	Comment & Significance
	Tephrosia leptoclada	-
	Tephrosia remotiflora	-
	Tephrosia rosea var. rosea	-
	Tephrosia sp.	Sterile
	Zornia chaetophora	-
Goodeniaceae	*Goodenia scaevolina*	-
	Goodenia sepalosa var. *sepalosa*	-
	Scaevola parvifolia subsp. *parvifolia*	-
	Velleia panduriformis	-
Gyrostemonaceae	*Codonocarpus cotinifolius*	-
	Gyrostemon tepperi	-
Malvaceae	*Abutilon australiense*	-
	Abutilon otocarpum	-
	Brachychiton diversifolius subsp. *diversifolius*	-
	Corchorus sidoides subsp. *sidoides*	-
	Corchorus sidoides subsp. *vermicularis*	-
	Gossypium australe	-
	Grewia breviflora	-
	Grewia pindanica	-
	Melhania oblongifolia	-
	Sida rohlenae subsp. *occidentalis*	-
	Sida sp. Pindan (B.G. Thomson 3398)	-
	Waltheria indica	-
Menispermaceae	*Tinospora smilacina*	-
Montiaceae	*Calandrinia strophiolata*	-
Moraceae	?*Ficus aculeata*	Sterile
	Ficus aculeata var. *indecora*	-
Myrtaceae	*Corymbia ?flavescens*	Sterile
	Corymbia flavescens	-
	Corymbia greeniana	-
	Corymbia paractia	Priority 1
	Corymbia zygophylla	-
	Eucalyptus tectifica	-
	Melaleuca nervosa	-
Nyctaginaceae	*Boerhavia gardneri*	-
Oleaceae	*Jasminum didymum* var. *lineare*	-
Orobanchaceae	*Buchnera asperata*	-
	Buchnera ramosissima	-
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*	-
	Phyllanthus maderaspatensis	-
	Synostemon rhytidospermus	-
Poaceae	?*Lolium perenne*	Weed; Insufficient material
	Aristida holathera var. *latifolia*	-
	Aristida hygrometrica	-
	Chrysopogon pallidus	-
	Digitaria bicornis	-
	Enneapogon pallidus	-
	Eragrostis eriopoda	-
	Eriachne melicacea	-
	Eriachne obtusa	-
	Eriachne pindanica	-
	Schizachyrium fragile	-
	Sorghum plumosum	-
	Sorghum timorense	-
	Triodia caelestialis	-
	Triodia schinzii	-
	Yakirra australiensis var. *australiensis*	-

Family	Taxon	Comment & Significance
Proteaceae	*Grevillea pyramidalis* subsp. *pyramidalis*	-
	Hakea macrocarpa	-
	Persoonia falcata	-
Rhamnaceae	*Ventilago viminalis*	-
Rubiaceae	*Dentella misera*	-
	Gardenia pyriformis subsp. *keartlandii*	-
	Oldenlandia mitrasacmoides subsp. *mitrasacmoides*	-
	Spermacoce occidentalis	-
Santalaceae	*Santalum lanceolatum*	-
Sapindaceae	*Atalaya hemiglauca*	-
	Dodonaea hispidula var. *arida*	-
Sapotaceae	*Sersalisia sericea*	PEC Indicator Species
Solanaceae	*Solanum dioicum*	-
Violaceae	*Hybanthus aurantiacus*	-
Zygophyllaceae	*Tribulopis angustifolia*	-

Appendix D: Site by Species Matrix

Taxa	DR01	DR02	DR03	DR04	DR05	QW01	QW02	QW03	QW04	QW05
?*Ficus aculeata*	-	-	-	-	-	-	-	-	-	-
?*Lolium perenne*	-	-	2	-	-	-	-	-	-	0.01
Abutilon australiense	-	-	-	-	-	0.01	-	-	-	-
Abutilon otocarpum	-	-	-	-	-	0.01	0.01	0.02	-	0.01
Acacia adoxa var. *subglabra*	-	-	-	-	-	1	-	-	-	-
Acacia colei var. *colei*	-	-	-	-	-	0.5	1	0.25	-	-
Acacia eriopoda	-	0.5	1.5	2	2	20.01	21	5	20	0.2
Acacia platycarpa	15	-	0.1	-	-	-	-	-	-	2
Acacia tumida var. *tumida*	-	-	-	-	-	-	-	-	-	-
Aristida holathera var. *latifolia*	-	-	-	-	-	0.3	0.1	0.5	1.5	0.2
Aristida hygrometrica	6.5	0.5	-	0.3	-	-	0.2	0.2	3	6
Atalaya hemiglauca	2	-	0.1	-	-	-	-	0.1	0.02	1
Bauhinia cunninghamii	3	-	3	6	-	0.2	2	6	-	3
Boerhavia gardneri	-	-	-	-	-	-	0.01	-	-	0.01
Bonamia ?media	-	-	-	-	-	-	-	0.1	-	-
Brachychiton diversifolius subsp. *diversifolius*	-	0.2	-	0.1	1	0.01	-	0.4	1.5	0.2
Buchnera asperata	-	-	-	-	-	-	-	0.01	-	-
Buchnera ramosissima	-	-	-	-	-	-	-	-	-	-
Bulbostylis barbata	-	-	-	-	-	-	-	0.01	0.01	0.01
Byblis filifolia	-	-	-	-	-	-	-	-	-	-
Cajanus marmoratus	0.5	0.1	-	-	-	-	-	0.01	-	-
Calandrinia strophiolata	-	-	-	-	-	-	0.01	0.01	0.01	-
Carissa lanceolata	-	-	0.5	-	-	-	-	1	-	0.2
Chamaecrista moorei	-	-	-	-	-	0.01	0.01	-	-	-
Chrysopogon pallidus	17	3	8	0.5	3	15	5	15	2	4
Cleome tetrandra var. *tetrandra*	-	-	-	-	-	0.01	0.01	0.01	-	-
Codonocarpus cotinifolius	-	-	0.1	-	-	-	0.1	-	0.1	-
Conyza bonariensis	-	-	-	-	-	-	-	-	-	0.01
Corchorus sidoides subsp. *sidoides*	-	-	-	-	-	0.11	-	0.2	-	-
Corchorus sidoides subsp. *vermicularis*	-	0.1	0.1	-	-	-	0.01	-	0.1	0.1
Corymbia ?flavescens	-	-	-	5	-	-	-	3	-	-
Corymbia flavescens	-	-	-	-	-	-	-	-	-	-
Corymbia greeniana	-	-	-	5	1	2	0.5	1	10	-
Corymbia paractia	-	-	-	-	-	-	-	-	-	-
Corymbia zygophylla	-	-	-	-	5	1	-	-	0.2	-
Crotalaria cunninghamii	2	-	-	-	-	-	-	-	-	0.1
Crotalaria medicaginea var. *neglecta*	0.2	-	-	-	-	-	0.01	-	0.01	0.1
Crotalaria ramosissima	-	-	-	-	-	0.01	0.01	0.01	-	-

Taxa	DR01	DR02	DR03	DR04	DR05	QW01	QW02	QW03	QW04	QW05
Cucumis variabilis	-	-	-	-	-	0.01	-	0.01	0.01	0.01
Cullen corallum	-	-	-	-	-	-	-	-	-	-
Cyperus conicus	-	-	-	-	-	-	-	-	-	-
Dentella misera	-	0.01	-	-	-	-	-	-	-	0.01
Digitaria bicornis	-	-	-	-	-	-	-	-	-	-
Dodonaea hispidula var. *arida*	-	-	-	-	-	1	-	-	-	-
Dolichandrone occidentalis	-	-	-	-	-	-	0.5	0.3	0.1	-
Ehretia saligna var. *saligna*	-	0.1	0.1	-	-	0.1	0.2	0.2	-	0.01
Enneapogon pallidus	-	-	-	-	-	-	-	-	-	0.01
Eragrostis eriopoda	-	2	-	-	-	-	0.01	-	0.01	0.01
Eriachne melicacea	-	-	-	-	0.5	-	0.1	0.05	3	-
Eriachne obtusa	-	-	-	-	-	1	-	-	-	-
Eriachne pindanica	-	-	-	-	-	0.01	-	0.1	-	0.01
Eucalyptus tectifica	-	-	-	5	-	-	-	-	-	-
Euphorbia coghlanii	-	-	-	-	-	0.01	0.01	0.01	0.01	-
Euphorbiaceae sp.	-	-	-	-	-	-	-	-	-	-
Evolvulus alsinoides var. *decumbens*	-	-	-	-	-	0.2	0.01	0.01	0.01	0.01
Fabaceae sp.	-	-	-	-	-	-	-	0.1	-	-
Ficus aculeata var. *indecora*	-	-	-	-	-	3	0.5	-	0.01	-
Fimbristylis oxystachya	-	-	-	-	-	0.01	0.01	-	-	-
Flueggea virosa subsp. *melanthesoides*	-	0.1	-	-	-	-	-	-	0.1	0.5
Gardenia pyriformis subsp. *keartlandii*	-	-	-	-	-	-	0.2	1	-	-
Glycine tomentella	-	-	-	-	-	0.02	0.1	0.02	-	-
Goodenia scaevolina	-	-	-	-	-	-	-	-	-	-
Goodenia sepalosa var. *sepalosa*	-	-	-	-	-	0.01	0.01	0.01	-	-
Gossypium australe	-	-	-	-	-	-	-	-	-	-
Grevillea pyramidalis subsp. *pyramidalis*	-	-	0.1	-	-	-	-	1	-	0.2
Grewia breviflora	1	-	0.2	-	-	-	-	0.1	-	2.01
Grewia pindanica	-	-	0.1	-	-	-	0.1	2	-	0.1
Gyrostemon tepperi	-	-	-	-	-	0.1	-	-	-	-
Hakea macrocarpa	-	-	0.2	2	-	-	-	-	0.01	0.01
Heliotropium leptaleum	-	-	-	-	-	0.01	0.01	-	-	-
Heliotropium ovalifolium	-	-	-	-	-	-	0.01	-	-	-
Hybanthus aurantiacus	-	-	-	-	-	0.01	0.01	-	0.01	-
Indigofera colutea	-	-	-	-	-	-	-	0.01	-	-
Indigofera linifolia	-	-	-	-	-	-	0.01	0.01	-	0.01
Ipomoea sp.	-	-	-	-	-	-	0.1	0.01	-	-
Jacksonia aculeata	-	-	-	-	-	-	0.01	-	-	-

Taxa	DR01	DR02	DR03	DR04	DR05	QW01	QW02	QW03	QW04	QW05
Jacquemontia sp. Broome (A.A. Mitchell 3028)	-	-	-	-	-	2	-	-	-	-
Jasminum didymum var. *lineare*	-	-	-	-	-	-	-	-	-	0.01
Marsdenia viridiflora subsp. *tropica*	-	-	-	-	-	0.02	-	0.01	0.01	-
Melaleuca nervosa	5	40	-	-	-	-	-	-	-	-
Melhania oblongifolia	-	-	-	-	-	0.1	-	0.1	-	0.1
Murdannia graminea	-	-	-	-	-	-	0.01	0.01	0.01	0.01
Oldenlandia mitrasacmoides subsp. *mitrasacmoides*	-	-	-	-	-	0.01	0.01	-	-	-
Operculina aequisepala	-	-	-	-	-	-	-	-	-	-
Persoonia falcata	-	-	-	-	-	-	0.1	0.01	-	0.01
Phyllanthus maderaspatensis	-	-	-	-	-	-	0.01	-	0.01	-
Polycarpaea longiflora	-	-	-	-	-	-	-	0.01	-	-
Pterocaulon intermedium	-	-	-	-	-	-	-	-	-	-
Pterocaulon serrulatum var. *velutinum*	0.5	0.1	-	-	-	-	-	-	-	0.51
Ptilotus exaltatus	-	-	-	-	-	-	0.01	-	-	-
Ptilotus lanatus	-	-	-	-	-	-	-	0.1	-	0.01
Ptilotus polystachyus	-	-	-	-	-	-	-	0.01	0.01	-
Rhynchosia minima	-	-	-	-	-	0.01	0.01	-	-	-
Santalum lanceolatum	-	-	2.5	-	-	-	-	-	-	-
Scaevola parvifolia subsp. *parvifolia*	-	0.01	-	-	-	-	-	-	-	-
Schizachyrium fragile	-	-	-	-	-	-	0.01	-	0.01	-
Scleria brownii	-	-	-	-	-	0.1	0.01	0.1	-	-
Senna costata	-	-	-	-	-	-	0.01	0.25	-	-
Senna notabilis	-	-	-	-	-	-	-	-	-	-
Sersalisia sericea	-	-	-	-	-	-	-	-	-	-
Sida rohlenae subsp. *occidentalis*	-	-	-	-	-	-	0.01	-	-	-
Sida sp. Pindan (B.G. Thomson 3398)	-	-	-	-	-	-	0.02	-	-	-
Solanum dioicum	-	-	-	-	-	0.1	0.01	-	0.01	0.01
Sorghum plumosum	-	-	-	4	30	3	0.2	3.05	0.5	0.01
Sorghum timorense	-	-	-	-	0.5	-	-	-	-	-
Spermacoce occidentalis	-	0.01	-	-	-	0.01	0.1	0.01	-	0.01
Stackhousia intermedia	-	-	-	-	-	-	0.01	-	0.01	-
Stylosanthes hamata	0.01	-	-	-	-	-	-	-	-	-
Stylosanthes scabra	-	-	-	-	-	-	-	-	-	-
Synostemon rhytidospermus	-	-	-	-	-	-	-	0.01	-	-
Tephrosia leptoclada	-	-	-	-	-	0.01	0.01	-	-	-
Tephrosia remotiflora	-	-	-	-	-	0.01	-	0.01	-	-
Tephrosia rosea var. *rosea*	-	-	-	-	-	-	-	-	-	-
Tephrosia sp.	-	-	-	-	-	-	-	-	-	-

Taxa	DR01	DR02	DR03	DR04	DR05	QW01	QW02	QW03	QW04	QW05
Terminalia ferdinandiana	-	-	-	-	1	-	-	-	0.1	-
Terminalia hadleyana	-	-	-	-	1	-	0.1	-	0.5	-
Terminalia kumpaja	-	-	-	-	-	-	-	0.01	-	-
Tinospora smilacina	-	-	-	-	-	0.01	0.01	0.01	0.01	0.01
Trachymene oleracea	-	-	-	-	-	-	-	-	-	-
Trianthema pilosum	-	0.01	1	-	-	0.01	0.01	0.02	0.01	-
Tribulopis angustifolia	-	-	-	-	-	-	-	-	0.01	0.01
Trichodesma zeylanicum	-	-	-	-	-	0.2	0.01	0.1	0.05	0.1
Triodia caelestialis	0.1	-	-	-	-	-	17	-	5	0.1
Triodia schinzii	-	4	-	0.1	-	25	-	3	-	-
Velleia panduriformis	-	-	-	-	-	-	-	-	-	-
Ventilago viminalis	-	-	-	-	-	0.01	-	-	-	0.2
Waltheria indica	-	-	-	-	-	0.2	-	0.01	0.01	0.01
Yakirra australiensis var. *australiensis*	-	-	-	-	-	0.02	0.01	0.1	0.01	-
Zornia chaetophora	-	-	-	-	-	-	-	0.01	-	0.01

Appendix E: Sites Sheets

Site: QW01	Type: Quadrat	Size: 50 x 50	Date: 20/04/2020	Botanist: CS

Landform:	Flat, Plain
Slope, aspect:	<1° - Level
Soil:	Clayey sand, Red
Rocks:	No Rocks
Abundance:	-
Size:	-
Fire:	2-5 years
Condition:	Excellent
Notes:	-
Veg Unit:	V001
Location (NW):	51 422737 8024105

Species	Height	Cover	Species	Height	Cover
Abutilon australiense	0.4	0.01	*Glycine tomentella*	0.1	0.01
Abutilon otocarpum	0.2	0.01	*Glycine tomentella*	0.2	0.01
Acacia adoxa var. *subglabra*	0.4	1	*Goodenia sepalosa var. sepalosa*	0.1	0.01
Acacia colei var. *colei*	2	0.5	*Gyrostemon tepperi*	1	0.1
Acacia eriopoda	4	20	*Heliotropium leptaleum*	0.3	0.01
Aristida holathera var. *latifolia*	0.3	0.3	*Hybanthus aurantiacus*	0.4	0.01
Bauhinia cunninghamii	2	0.2	*Jacquemontia* sp. Broome (A.A. Mitchell 3028)	0.4	2
Brachychiton diversifolius subsp. *diversifolius*	1.5	0.01	*Marsdenia viridiflora* subsp. *tropica*	0.2	0.01
Chamaecrista moorei	0.3	0.01	*Melhania oblongifolia*	0.4	0.1
Chrysopogon pallidus	0.4	15	*Oldenlandia mitrasacmoides* subsp. *mitrasacmoides*	0.3	0.01
Cleome tetrandra var. *tetrandra*	0.2	0.01	*Rhynchosia minima*	0.1	0.01
Corchorus sidoides subsp. *sidoides*	0.3	0.1	*Scleria brownii*	0.4	0.1
Corymbia greeniana	3	2	*Solanum dioicum*	0.3	0.1
Corymbia zygophylla	3	1	*Sorghum plumosum*	0.4	3
Crotalaria ramosissima	0.2	0.01	*Spermacoce occidentalis*	0.1	0.01
Cucumis variabilis	0.2	0.01	*Tephrosia leptoclada*	0.2	0.01
Dodonaea hispidula var. *arida*	0.5	1	*Tephrosia remotiflora*	0.1	0.01
Ehretia saligna var. *saligna*	2	0.1	*Tinospora smilacina*	0.1	0.01
Eriachne obtusa	0.4	1	*Trianthema pilosum*	0.1	0.01
Eriachne pindanica	0.2	0.01	*Trichodesma zeylanicum*	0.2	0.2
Euphorbia coghlanii	0.2	0.01	*Triodia schinzii*	0.4	25
Evolvulus alsinoides var. *decumbens*	0.3	0.2	*Ventilago viminalis*	1	0.01
Ficus aculeata var. *indecora*	2.5	3	*Waltheria indica*	0.3	0.2
Fimbristylis oxystachya	0.1	0.01	*Yakirra australiensis* var. *australiensis*	0.2	0.01

Site: QW02	Type: Quadrat	Size: 50 x 50	Date: 18/04/2020	Botanist: CP

Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle, S
Soil:	Clayey sand, Orange
Rocks:	No Rocks
Abundance:	-
Size:	-
Fire:	>5 years
Condition:	Excellent
Notes:	-
Veg Unit:	V001
Location (NW):	51 422797 8024943

Species	Height	Cover	Species	Height	Cover
Abutilon otocarpum	0.15	0.01	*Heliotropium leptaleum*	0.3	0.01
Acacia colei var. *colei*	2.5	1	*Heliotropium ovalifolium*	0.15	0.01
Acacia eriopoda	3	21	*Hybanthus aurantiacus*	0.35	0.01
Aristida holathera var. *latifolia*	0.4	0.1	*Indigofera linifolia*	0.2	0.01
Aristida hygrometrica	0.4	0.2	*Ipomoea* sp.	0.01	0.1
Bauhinia cunninghamii	2.6	2	*Jacksonia aculeata*	0.35	0.01
Boerhavia gardneri	0.2	0.01	*Murdannia graminea*	0.4	0.01
Calandrinia strophiolata	0.15	0.01	*Oldenlandia mitrasacmoides* subsp. *mitrasacmoides*	0.35	0.01
Chamaecrista moorei	0.3	0.01	*Persoonia falcata*	1.7	0.1
Chrysopogon pallidus	0.5	5	*Phyllanthus maderaspatensis*	0.25	0.01
Cleome tetrandra var. *tetrandra*	0.2	0.01	*Ptilotus exaltatus*	0.1	0.01
Codonocarpus cotinifolius	0.5	0.1	*Rhynchosia minima*	0.3	0.01
Corchorus sidoides subsp. *vermicularis*	0.3	0.01	*Schizachyrium fragile*	0.3	0.01
Corymbia greeniana	3	0.5	*Scleria brownii*	0.3	0.01
Crotalaria medicaginea var. *neglecta*	0.2	0.01	*Senna costata*	0.9	0.01
Crotalaria ramosissima	0.2	0.01	*Sida rohlenae* subsp. *occidentalis*	0.4	0.01
Dolichandrone occidentalis	1.8	0.5	*Sida* sp. *Pindan (B.G. Thomson 3398)*	0.3	0.01
Ehretia saligna var. *saligna*	1.8	0.2	*Solanum dioicum*	0.4	0.01
Eragrostis eriopoda	0.35	0.01	*Sorghum plumosum*	0.01	0.2
Eriachne melicacea	0.4	0.1	*Spermacoce occidentalis*	0.2	0.1
Euphorbia coghlanii	0.2	0.01	*Stackhousia intermedia*	0.3	0.01
Evolvulus alsinoides var. *decumbens*	0.2	0.01	*Tephrosia leptoclada*	0.25	0.01
Ficus aculeata var. *indecora*	2.4	0.5	*Terminalia hadleyana*	2.2	0.1
Fimbristylis oxystachya	0.3	0.01	*Tinospora smilacina*	0.2	0.01
Gardenia pyriformis subsp. *keartlandii*	2.4	0.2	*Trianthema pilosum*	0.1	0.01
Glycine tomentella	0.2	0.1	*Trichodesma zeylanicum*	0.2	0.01
Goodenia sepalosa var. *sepalosa*	0.2	0.01	*Triodia caelestialis*	0.4	17
Grewia pindanica	3.5	0.1	*Yakirra australiensis* var. *australiensis*	0.15	0.01

Site: QW03	Type: Quadrat	Size: 50 x 50	Date: 20/04/2020	Botanist: CS

Landform:	Flat, Plain
Slope, aspect:	<1° - Level
Soil:	Clayey sand, Red
Rocks:	No Rocks
Abundance:	-
Size:	-
Fire:	2-5 years
Condition:	Excellent
Notes:	-
Veg Unit:	V001
Location (NW):	51 449797 8028067

Species	Height	Cover	Species	Height	Cover
Abutilon otocarpum	0.1	0.01	*Glycine tomentella*	0.1	0.01
Acacia colei var. *colei*	3	0.25	*Goodenia sepalosa* var. *sepalosa*	0.1	0.01
Acacia eriopoda	3	5	*Grevillea pyramidalis* subsp. *pyramidalis*	1.5	1
Aristida holathera var. *latifolia*	0.3	0.5	*Grewia breviflora*	1.2	0.1
Aristida hygrometrica	0.3	0.2	*Grewia pindanica*	1.5	2
Atalaya hemiglauca	0.5	0.1	*Indigofera colutea*	0.15	0.01
Bauhinia cunninghamii	3.5	6	*Indigofera linifolia*	0.25	0.01
Bonamia ?media	0.1	0.1	*Ipomoea* sp.	0.1	0.01
Brachychiton diversifolius subsp. *diversifolius*	4	0.2	*Marsdenia viridiflora* subsp. *tropica*	0.6	0.01
Buchnera asperata	0.4	0.01	*Melhania oblongifolia*	0.4	0.1
Bulbostylis barbata	0.1	0.01	*Murdannia graminea*	0.2	0.01
Cajanus marmoratus	0.3	0.01	*Persoonia falcata*	0.3	0.01
Calandrinia strophiolata	0.2	0.01	*Polycarpaea longiflora*	0.2	0.01
Carissa lanceolata	1.75	1	*Ptilotus lanatus*	0.5	0.1
Chrysopogon pallidus	0.4	15	*Ptilotus polystachyus*	0.5	0.01
Cleome tetrandra var. *tetrandra*	0.1	0.01	*Scleria brownii*	0.2	0.1
Corchorus sidoides subsp. *sidoides*	0.2	0.1	*Senna costata*	2	0.25
Corymbia ?flavescens	8	3	*Sorghum plumosum*	0.4	3
Corymbia greeniana	4.5	1	*Spermacoce occidentalis*	0.1	0.01
Crotalaria ramosissima	0.1	0.01	*Synostemon rhytidospermus*	0.5	0.01
Cucumis variabilis	0.2	0.01	*Tephrosia remotiflora*	0.5	0.01
Dolichandrone occidentalis	4	0.3	*Terminalia kumpaja*	0.5	0.01
Ehretia saligna var. *saligna*	2	0.2	*Tinospora smilacina*	0.2	0.01
Eriachne melicacea	0.3	0.05	*Trianthema pilosum*	0.1	0.01
Eriachne pindanica	0.2	0.1	*Trichodesma zeylanicum*	0.3	0.1
Euphorbia coghlanii	0.1	0.01	*Triodia schinzii*	0.4	3
Evolvulus alsinoides var. *decumbens*	0.2	0.01	*Waltheria indica*	1.2	0.01
Fabaceae sp.	1.2	0.1	*Yakirra australiensis* var. *australiensis*	0.2	0.1
Gardenia pyriformis subsp. *keartlandii*	2.5	1	*Zornia chaetophora*	0.25	0.01

Site: QW04	Type: Quadrat	Size: 50 x 50	Date: 20/04/2020	Botanist: CP

Landform:	Flat, Plain
Slope, aspect:	1° - Very Gentle
Soil:	Clayey sand; Red, Orange
Rocks:	No Rocks
Abundance:	-
Size:	-
Fire:	2-5 years
Condition:	Excellent
Notes:	-
Veg Unit:	V001
Location (NW):	51 450199 8027895

Species	Height	Cover	Species	Height	Cover
Acacia eriopoda	3.2	20	*Flueggea virosa* subsp. *melanthesoides*	1.5	0.1
Aristida holathera var. *latifolia*	0.4	1.0	*Hakea macrocarpa*	2.1	0.01
Aristida hygrometrica	0.45	3	*Hybanthus aurantiacus*	0.3	0.01
Atalaya hemiglauca	1.2	0.01	*Marsdenia viridiflora* subsp. *tropica*	0.3	0.01
Brachychiton diversifolius subsp. *diversifolius*	4.5	1.5	*Murdannia graminea*	0.4	0.01
Bulbostylis barbata	0.15	0.01	*Phyllanthus maderaspatensis*	0.3	0.01
Calandrinia strophiolata	0.1	0.01	*Ptilotus polystachyus*	0.4	0.01
Chrysopogon pallidus	0.4	2	*Schizachyrium fragile*	0.15	0.01
Codonocarpus cotinifolius	0.9	0.1	*Solanum dioicum*	0.35	0.01
Corchorus sidoides subsp. *vermicularis*	0.3	0.1	*Sorghum plumosum*	1.1	0.5
Corymbia greeniana	6.5	10	*Stackhousia intermedia*	0.3	0.01
Corymbia zygophylla	3.5	0.2	*Terminalia ferdinandiana*	2.2	0.1
Crotalaria medicaginea var. *neglecta*	0.25	0.01	*Terminalia hadleyana*	4.5	0.5
Cucumis variabilis	0.3	0.01	*Tinospora smilacina*	0.9	0.01
Dolichandrone occidentalis	3	0.1	*Trianthema pilosum*	0.1	0.01
Eragrostis eriopoda	0.3	0.01	*Tribulopis angustifolia*	0.15	0.01
Eriachne melicacea	0.4	3	*Trichodesma zeylanicum*	0.5	0.04
Euphorbia coghlanii	0.15	0.01	*Triodia caelestialis*	0.4	5
Evolvulus alsinoides var. *decumbens*	0.2	0.01	*Waltheria indica*	0.4	0.01
Ficus aculeata var. *indecora*	0.5	0.01	*Yakirra australiensis* var. *australiensis*	0.15	0.01

Site: QW05	Type: Quadrat	Size: 50 x 50	Date: 20/04/2020	Botanist: CP

Landform:	Drainage, Drainage line on flat
Slope, aspect:	Gentle - 3°, S
Soil:	Sandy clay, Light orange
Rocks:	No rocks
Abundance:	
Size:	
Fire:	2-5 years
Condition:	Excellent
Notes:	-
Veg Unit:	V002
Location (NW):	51 449030 8027941

Species	Height	Cover	Species	Height	Cover
?Lolium perenne	0.7	0.01	*Flueggea virosa* subsp. *melanthesoides*	1.5	0.5
Abutilon otocarpum	0.4	0.01	*Grevillea pyramidalis* subsp. *pyramidalis*	1.9	0.2
Acacia eriopoda	2.5	0.2	*Grewia breviflora*	0.5	0.01
Acacia platycarpa	2.2	2	*Grewia breviflora*	3.2	2
Aristida holathera var. *latifolia*	0.3	0.2	*Grewia pindanica*	0.8	0.1
Aristida hygrometrica	0.5	6	*Hakea macrocarpa*	1.8	0.01
Atalaya hemiglauca	0.9	0.5	*Indigofera linifolia*	0.2	0.01
Bauhinia cunninghamii	3	3	*Jasminum didymum* var. *lineare*	0.9	0.01
Boerhavia gardneri	0.2	0.01	*Melhania oblongifolia*	0.4	0.1
Brachychiton diversifolius subsp. *diversifolius*	2.8	0.2	*Murdannia graminea*	0.4	0.01
Bulbostylis barbata	0.15	0.01	*Persoonia falcata*	2.4	0.01
Carissa lanceolata	1.6	0.2	*Pterocaulon serrulatum* var. *velutinum*	0.4	0.3
Chrysopogon pallidus	0.4	4	*Ptilotus lanatus*	0.3	0.01
Conyza bonariensis	0.3	0.01	*Solanum dioicum*	0.4	0.01
Corchorus sidoides subsp. *vermicularis*	0.3	0.1	*Sorghum plumosum*	1	0.01
Crotalaria cunninghamii	1.5	0.1	*Spermacoce occidentalis*	0.15	0.01
Crotalaria medicaginea var. *neglecta*	0.6	0.1	*Tinospora smilacina*	1.5	0.01
Cucumis variabilis	0.6	0.01	*Tribulopis angustifolia*	0.2	0.01
Dentella misera	0.05	0.01	*Trichodesma zeylanicum*	0.8	0.1
Ehretia saligna var. *saligna*	2.5	0.01	*Triodia caelestialis*	0.3	0.1
Enneapogon pallidus	0.5	0.01	*Ventilago viminalis*	4.5	0.2
Eragrostis eriopoda	0.3	0.01	*Waltheria indica*	0.4	0.01
Eriachne pindanica	0.2	0.01	*Zornia chaetophora*	0.3	0.01
Evolvulus alsinoides var. *decumbens*	0.2	0.01			

Site: DR01	Type: Releve	Size: NA	Date: 20/04/2020	Botanist: CP

Landform:	Drainage, Drainage line on flat
Slope, aspect:	Very gentle - 1°, S
Soil:	Sandy clay, Light orange
Rocks:	No rocks
Abundance:	
Size:	
Fire:	<1 year
Condition:	Excellent
Notes:	-
Veg Unit:	-
Location (NW):	51 449030 8027941

Species	Height	Cover	Species	Height	Cover
Acacia platycarpa	2.2	15	*Crotalaria medicaginea* var. *neglecta*	0.5	0.2
Aristida hygrometrica	0.5	5	*Grewia breviflora*	1.2	1
Atalaya hemiglauca	1.5	1	*Melaleuca nervosa*	1.8	5
Bauhinia cunninghamii	4	3	*Pterocaulon serrulatum* var. *velutinum*	0.4	0.5
Cajanus marmoratus	0.25	0.5	*Stylosanthes hamata*	0.4	0.01
Chrysopogon pallidus	0.4	15	*Triodia caelestialis*	0.3	0.1
Crotalaria cunninghamii	1.2	2			

Site: DR02	Type: Releve	Size: NA	Date: 20/04/2020	Botanist: CS
Landform:	Flat, Plain			
Slope, aspect:	Very gentle - 1°, S			
Soil:	Sandy clay, orange			
Rocks:	No rocks			
Abundance:				
Size:				
Fire:	<1 year			
Condition:	Excellent			
Notes:	-			
Veg Unit:	-			
Location (NW):	51 448928 8027745			

Species	Height	Cover	Species	Height	Cover
Acacia eriopoda	0.9	0.5	*Eragrostis eriopoda*	0.4	2
Aristida hygrometrica	0.3	0.5	*Flueggea virosa* subsp. *melanthesoides*	0.8	0.1
Brachychiton diversifolius subsp. *diversifolius*	2.8	0.2	*Melaleuca nervosa*	0.4	40
Cajanus marmoratus	0.15	0.1	*Pterocaulon serrulatum* var. *velutinum*	0.4	0.1
Chrysopogon pallidus	0.3	3	*Scaevola parvifolia* subsp. *parvifolia*	0.2	0.01
Corchorus sidoides subsp. *vermicularis*	0.3	0.1	*Spermacoce occidentalis*	0.1	0.01
Dentella misera	0.05	0.01	*Trianthema pilosum*	0.1	0.01
Ehretia saligna var. *saligna*	0.5	0.1	*Triodia schinzii*	0.3	4

Site: DR03	Type: Releve	Size: NA	Date: 21/04/2020	Botanist: CP
Landform:	Flat, Plain			
Slope, aspect:	Level - 1°			
Soil:	Sandy clay, light orange			
Rocks:	No rocks			
Abundance:				
Size:				
Fire:	<1 year			
Condition:	Excellent			
Notes:	Similar to QW05, just recently burnt			
Veg Unit:	-			
Location (NW):	51 449175 8028350			

Species	Height	Cover	Species	Height	Cover
?Lolium perenne	0.4	2	*Corchorus sidoides* subsp. *vermicularis*	0.3	0.1
Acacia eriopoda	0.7	1.5	*Ehretia saligna* var. *saligna*	0.9	0.1
Acacia platycarpa	0.4	0.1	*Grevillea pyramidalis* subsp. *pyramidalis*	1.6	0.1
Atalaya hemiglauca	2.2	0.1	*Grewia breviflora*	1.5	0.2
Bauhinia cunninghamii	3	3	*Grewia pindanica*	0.5	0.1
Carissa lanceolata	0.5	0.5	*Hakea macrocarpa*	2.2	0.2
Chrysopogon pallidus	0.6	8	*Santalum lanceolatum*	0.6	2.5
Codonocarpus cotinifolius	1.7	0.1	*Trianthema pilosum*	0.05	1

Site: DR04	Type: Releve	Size: NA	Date: 21/04/2020	Botanist: CS
Landform:	Flat, Plain			
Slope, aspect:	Level - 1°			
Soil:	Sandy clay, orange			
Rocks:	No rocks			
Abundance:				
Size:				
Fire:	<1 year			
Condition:	Excellent			
Notes:	Burnt recently			
Veg Unit:	-			
Location (NW):	51 449563 8028812			

Species	Height	Cover	Species	Height	Cover
Acacia eriopoda	1.5	2	*Corymbia greeniana*	0.3	0.1
Aristida hygrometrica	0.4	0.3	*Eucalyptus tectifica*	0.9	0.1
Bauhinia cunninghamii	4	6	*Hakea macrocarpa*	2.2	0.2
Brachychiton diversifolius subsp. *diversifolius*	2.5	0.1	*Santalum lanceolatum*	0.6	2.5
Corymbia ?flavescens	10	5	*Sorghum plumosum*	1.5	0.2
Chrysopogon pallidus	0.6	8	*Trianthema pilosum*	0.05	1
Codonocarpus cotinifolius	1.7	0.1	*Triodia schinzii*	0.5	0.1

Site: DR05	Type: Releve	Size: NA	Date: 21/04/2020	Botanist: CP
Landform:	Flat, Plain			
Slope, aspect:	Very Gentle - 1°			
Soil:	Clayey sand, red orange			
Rocks:	No rocks			
Abundance:				
Size:				
Fire:	<1 year			
Condition:	Excellent			
Notes:	-			
Veg Unit:	-			
Location (NW):	51 450292 8027532			

Species	Height	Cover	Species	Height	Cover
Acacia eriopoda	0.6	2	*Sorghum plumosum*	2	30
Aristida hygrometrica	0.45	1	*Sorghum timorense*	0.4	0.5
Brachychiton diversifolius subsp. *diversifolius*	4	1	*Terminalia ferdinandiana*	4.5	1
Corymbia greeniana	5	1	*Terminalia hadleyana*	5	1
Corymbia zygophylla	5	5	*Hakea macrocarpa*	2.2	0.2
Chrysopogon pallidus	0.6	8	*Santalum lanceolatum*	0.6	2.5
Codonocarpus cotinifolius	1.7	0.1	*Trianthema pilosum*	0.05	1
Eriachne melicacea	0.4	0.5			

APPENDIX C
10 Clearing Principles Memo

MEMO

BROOME REGIONAL RESOURCE RECOVERY PARK TEN CLEARING PRINCIPLES

PREPARED FOR: SHIRE OF BROOME

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Project ID: 2038	Broome Regional Resource Recovery Park Ten Clearing Principles
Prepared for:	Shire of Broome
Date of issue:	10/8/21
Prepared by:	Jordan Whitmore
Spectrum Review:	Melissa Hay

1. INTRODUCTION & BACKGROUND

The Shire of Broome is developing the Regional Resource Recovery Park (RRRP) located at Lot 550 on Deposited Plan 421448 (the Study Area). The RRRP consist of a community Recycling Centre and Class III landfill. The Study Area is 121 hectares and located approximately 10 km north of Broome.

Spectrum Ecology have previously undertaken a Detailed Flora and Vegetation Assessment (Spectrum Ecology, 2020a), and Terrestrial Fauna Assessment (Spectrum Ecology, 2020b) for the Study Area which included a desktop-based assessment and systematic targeted surveys for species' likely to occur within. The assessments determined the existing conditions and natural values within the Study Area which were used, in part, to assess vegetation clearing associated with hydrogeological and geotechnical site investigations. The ecological values were assessed against the ten clearing principles as stipulated under Schedule 5 of the of the *Environment Protection Act 1986* which found the site values relative to the investigations were not at variance to any of the clearing principles.

The proponent is now undertaking detailed design of the RRRP which proposes impacts of 69.02 hectares within a Development Footprint (Talis Figure 02.).

2. ASSESSMENT OBJECTIVES

Schedule 5 of the *Environmental Protection Act 1986* stipulates that any development that has the potential to impact native vegetation within Western Australia, unless exempt, is required to be assessed against the ten clearing principles in order to obtain a clearing permit.

The Schedules states native vegetation should not be cleared if the proposed works are at variance to the following principles:

a) It comprises a high level of biodiversity;
b) It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna;
c) It includes, or is necessary for the continued existence of, threatened flora;
d) It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
e) It is significant as a remnant of native vegetation in an area that has been extensively cleared;
f) It is growing in, or in association with, an environment associated with a watercourse or wetland;
g) The clearing of the vegetation is likely to cause appreciable land degradation;
h) The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
i) The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; and,
j) The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

This memo reviews the results from both flora and fauna assessments (Spectrum Ecology 2020a, Spectrum Ecology 2020b) with the aim to identify any variances to the ten clearing principles as stipulated in Schedule 5 of the *Environmental Protection Act 1986* in relation to the proposed Development Footprint within the Study Area.

3. STUDY AREA

3.1. Broome RRRP Development

The Study Area is located 12 kilometres north east of Broome municipality (Map 1.1) and covers an area of 121 hectares. The Study Area is bound by McGuigan Road to the north, Broome-Cape Leveque road to the east, undeveloped land to the south, and Yawuru Indigenous Protected Area to the west. The Study Area was entirely vegetated except for a single internal access track within the north eastern corner, and three artificial drainage lines associated with the Broome-Cape Leveque Road. No springs or waterways were observed and/or mapped within the Study Area.

The proposed Development Footprint totals 69.02 hectares and is positioned within the entire southern section of the Study Area (Talis Figure 02.). The proposed Development Footprint includes areas designated for the CRC development, levee installation, and areas designated for future development. The figure provided shows the recorded locations of significant flora and Priority Ecological Communities (PEC's) as recorded within the Detailed Flora and Vegetation Assessment (Spectrum Ecology, 2020a).

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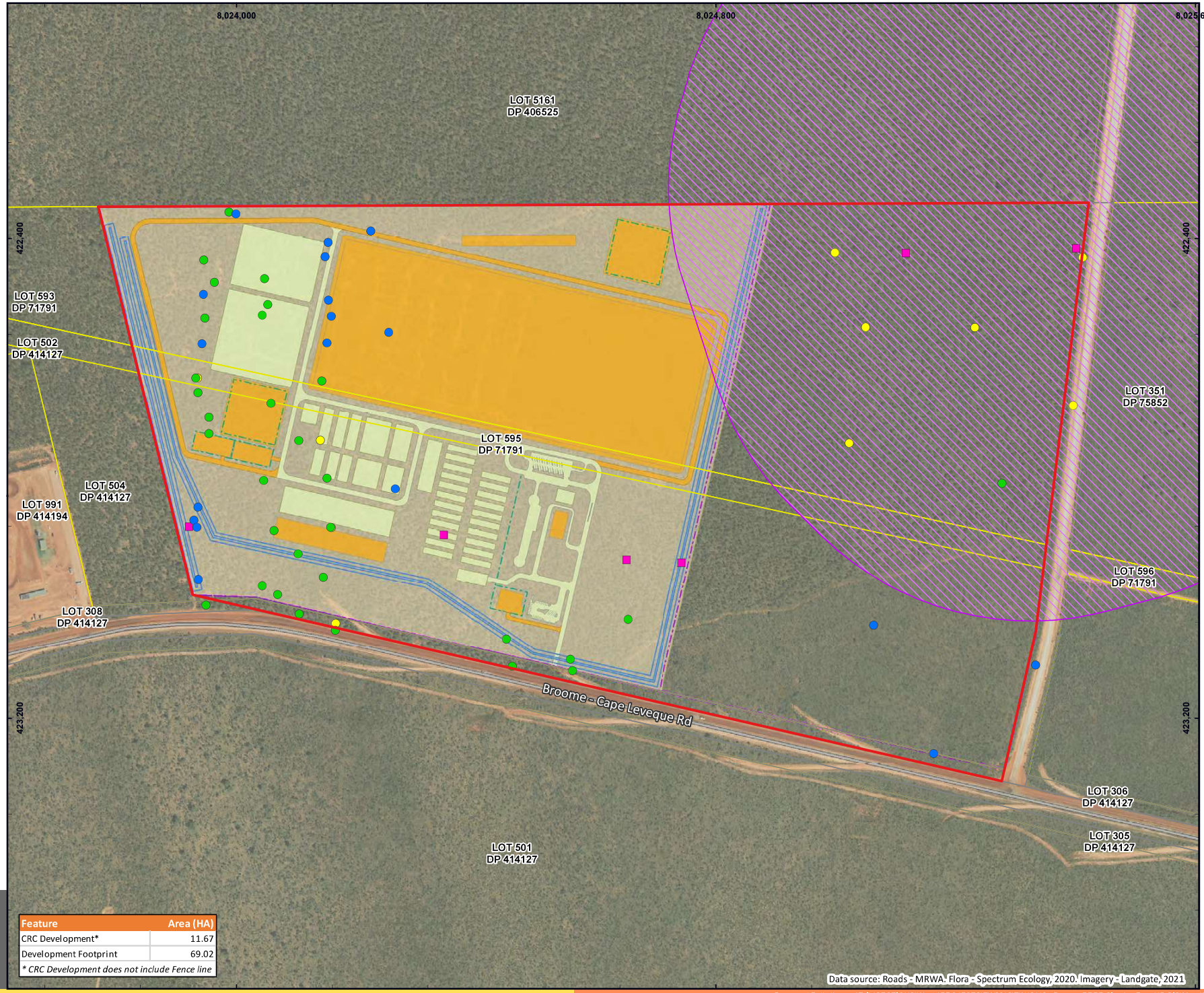

Feature	Area (HA)
CRC Development*	11.67
Development Footprint	69.02

** CRC Development does not include Fence line*

Data source: Roads - MRWA; Flora - Spectrum Ecology, 2020; Imagery - Landgate, 2021

LEGEND

- Boundary Fence
- Security Fence (Future)
- Secondary Road
- Site Boundary
- Priority Ecological Communities (PEC)
- Levee
- CRC Development
- Future Development
- Development Footprint

Significant Flora

- Sersalisia sericea (PEC Indicator Species)
- Corymbia paractia (P1)
- Jacquemontia sp. Broome (A.A. Mitchell 3028) (P1)
- Terminalia kumpaja (P3)

SITE DEVELOPMENT AND SIGNIFICANT FLORA

LOT No.593 / 595 / 990
Cape Leveque Road

Clearing Permit Application
Shire of Broome

N 0 50 100 150 200 M

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:6,000

Prepared:	N Johnston	Date:	26/07/2021
Reviewed:	E Porter	Revision:	C
Project:	TW19113		

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Figure 02

3.2. Bioregion

The Study Area is located within the Pindanland (DAL02) IBRA subregion within the larger Dampierland (DAL) region (Figure 3.1). The Pindanland subregion comprises the western half of Dampierland, including the sandplains of the Dampier Peninsula, extending south along the hinterland of Eighty Mile Beach and north to include the paleodelta of the Fitzroy River (Graham, 2002). The dominant land uses for the Pindanland subregion include grazing on native pastures, unallocated crown land, and crown reserves. At the time of survey, the most recent fire within the Study Area and surrounds occurred in 2019.

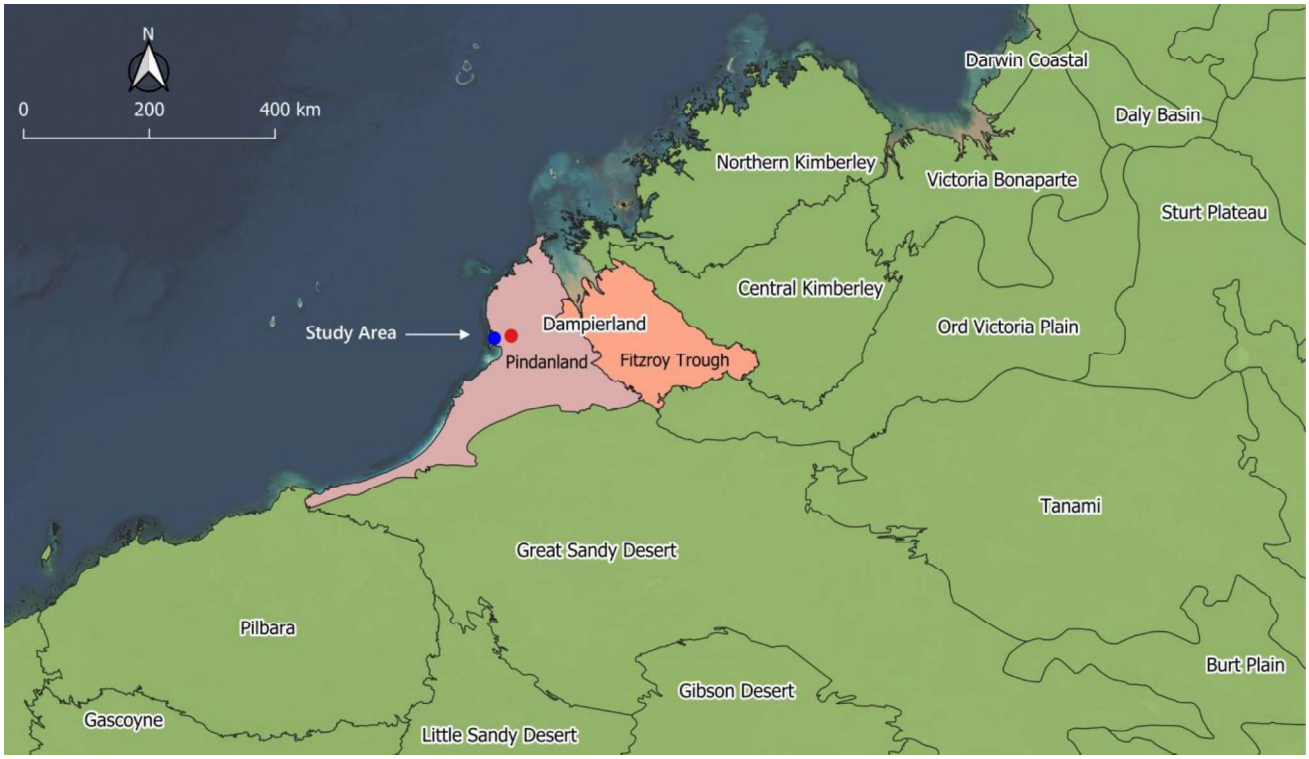

Figure 3.1: IBRA Classification of the Study Area

3.3. Beard Vegetation

The Study Area occurs entirely within one vegetation sub-association (750.1). This sub-association is restricted to the Dampierland IBRA region but is the second largest sub-association within the region and widespread with 99.7% remaining. The vegetation classification is listed in Table 3.1.

Table 3.1: Beard Vegetation

Sub-association	NVIS Level VI Vegetation Description	Area in Study (ha)	% of Study Area	Pre-European Whole State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Land
750.1	*Corymbia polycarpa*, *Corymbia papuana* and *Corymbia setosa* woodland, over *Acacia eriopoda*, *Acacia holosericea* and *Dolichandrone occidentalis* tall shrubland, over *Chrysopogon* sp. open tussock grassland	121	100%	1,221,911.2	1,218,020.5	99.7	2.7

DBCA= Department of Biodiversity, Conservation and Attractions

3.4. Flora

3.4.1. Desktop Assessment

Twenty significant flora taxa were recovered during the flora desktop assessment. One Threatened species, *Seringia exastia*, was assigned a Medium likelihood of occurring within the Study Area due to its proximity (<10 km) and the possibility of suitable habitat occurring. This Threatened species, however, is in the process of being reclassified to a non - Threatened or Priority species and is common throughout Western Australia.

Table 3.2 lists the previous assessments conducted within in proximity to the Study Area which were revied within the Detailed Flora and Vegetation Assessment (Spectrum Ecology 2020a).

Table 3.2: Previously Conducted Flora Assessments

Report Title	Level of Assessment	Field Survey Timing
Mamabulanjin Orchard Flora and Fauna Survey (GHD, 2019).	Detailed and targeted flora & vegetation. Level 1 and targeted fauna.	1–2 May 2019 (flora & vegetation).
Distribution, ecology and cultural importance of Gunurru or Cable Beach Ghost Gum *Corymbia paractia* in the Broome area, Western Australia (Environs Kimberley, 2018).	Targeted survey and distribution mapping of Cable Beach Ghost Gum *Corymbia paractia*.	November – December 2016 (flowering period).
Broome Road Industrial Area Targeted Survey (GHD, 2018).	Targeted flora survey (*Polymeria* sp. Broome and *Jacquemontia* sp. Broome).	24–27 April 2017, 10–12 May 2017.
Flora, Vegetation and Fauna Assessment – Broome Asparagus Farm (AECOM, 2017).	Detailed (single phase) flora & vegetation, Level 1 fauna.	8–12 May 2017 (Flora).
Broome Landfill Flora, Vegetation and Fauna Survey (Astron, 2017).	Level 2 flora & vegetation, Level 1 fauna.	2–3 November 2016 (Flora & Fauna). 3–5 April 2017 (Flora).
Broome Motorplex Environmental Site Investigation (GHD, 2016).	Level 2 (single phase) flora & vegetation.	18–24 March 2016 (flora & vegetation).

Report Title	Level of Assessment	Field Survey Timing
Priority Ecological Community (PEC) Mapping and condition assessment: "Relict dune system dominated by extensive stands of Mangarr (Minyjuru) *Sersalisia* (formerly *Pouteria*) *sericea*" (Willing & Beames, 2015)^	Targeted survey and condition assessment of the Minyjuru (*Sersalisia sericea*) dominated relict dune system PEC.	November 2013 – March 2014.
Broome North – Northern Portion (Area B). Preliminary Environmental Impact Assessment and Biological Survey (GHD, 2009).	Level 1 flora & vegetation.	Field: 3–6 June 2008.

^ Exact location not known

3.4.2. Detailed Flora and Vegetation Assessment (Spectrum Ecology 2020a)

A total of 127 taxa from 39 families and 93 genera were recorded during the survey. The most species rich family was Fabaceae, with 26 species from 14 genera recorded, followed by Poaceae with 16 species from 11 genera. The most species rich genus was *Acacia* with five species recorded. Of the 125 taxa recorded, three were significant flora and four were introduced species.

3.4.2.1. Significant Flora

No Threatened Flora taxa were recorded within the Study Area. Three Priority Flora taxa were recorded within the Study Area:

- *Corymbia paractia* (Priority 1);
- *Jacquemontia* sp. Broome (A.A. Mitchell 3028) (Priority 1); and
- *Terminalia kumpaja* (Priority 3).

3.4.2.2. TEC & PEC Communities

Twelve ecosystems of conservation significance, consisting of 118 records, were identified from the database search and are listed in Table 3.3.

One floristic Threatened Ecological Community (TEC) occurs within 50 km of the Study Area (Table 3.3). The Monsoon Thickets TEC is listed as Vulnerable and restricted to coastal sand dunes. The Study Area has a low likelihood of containing the Monsoon Thickets TEC as they are mapped on different geological and vegetation units.

Four Priority 1 Priority Ecological Communities (PECs) were recorded within 50 km of the Study Area (Table 3.3). The Mangarr (Minyjuru) P1 PEC was recorded within the north-west corner of the Study Area. The *Corymbia paractia* P1 PEC was classified as a high likelihood of occurring within the Study Area due to their proximity to the PEC and potential for suitable habitat within the Study Area. The Dwarf Pindan Heath P1 PEC and Vegetation Association 770 P1 PEC were classified as low likelihood of occurring within the Study Area due to their location and vegetation description.

Five Priority 3 and one Priority 4 PECs occurred within 50 km of the Study Area (Table 3.3). The Vegetation Association 73 P3 PEC was classified as a medium likelihood of occurring within both Study Area due to the close proximity to the PEC buffer.

Table 3.3: TEC & PEC Desktop Assessment

Likelihood		Status	PEC	Description	Distance from Project
D2	G1				
Low	Low	Vulnerable / Endangered TEC	Monsoon Thickets	Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula.	5.9 km SE
Low	Low	Vulnerable TEC	Roebuck Bay Mudflats	Species-rich faunal community of the intertidal mudflats of Roebuck Bay.	0.6 km S
High	Low	PEC P1	*Corymbia paractia*	*Corymbia paractia* dominated community on dunes.	5.2 km SE
Low	Low		Dwarf Pindan Heath	Dwarf pindan heath community of Broome coast.	14.0 km SE
Recorded	Low		Mangarr (Minyjuru)	Relict dune system dominated by extensive stands of Minyjuru (Mangarr - *Sersalisia sericea*).	Within buffer
Low	Low		Vegetation Association 770	Shrublands; Wattle thicket near Broome.	4.9 km E
Low	Low	PEC P3	Eighty Mile Land System	Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands.	41.7 km S
Low	Low		Roebuck Land System	Paleo-tidal coastal plains and tidal flats with saline soil supporting salt-water couch grasslands, samphire low shrublands, melaleuca thickets and mangroves.	10.1 km SW
Low	Low		Vegetation Association 37	Shrublands; teatree thicket.	31 km SW
Low	Low		Vegetation Association 67	Grasslands, tall bunch grass savanna, sparse low tree; ribbon grass & paperbarks.	39.9 km SE
Medium	Medium		Vegetation Association 73	Grasslands, short bunch grass savanna, grass; salt water grassland (*Sporobolus virginicus*).	3.1 km W
Low	Low	PEC P4	Nimalarica Claypan	Nimalaica claypan is a unique, almost permanent, freshwater lake inland from Willie Creek, Broome.	7.9 km N

3.5. Vegetation

3.5.1. Vegetation Types

Two vegetation types were recorded; however, only one vegetation type was recorded within the Study Area. The two vegetation types are described in Table 3.4.

Table 3.4: Vegetation Types

Unit	Description	Associated Species (Priority Species in Bold)	Quadrats	Area (ha)	Representative Photo
V001	*Corymbia greeniana low open woodland* with *Acacia eriopoda* and *Bauhinia cunninghamii* tall open shrubland, over *Triodia schinzii* and *Triodia caelestialis* low sparse hummock grassland and *Chrysopogon pallidus* and *Sorghum plumosum* low sparse tussock grassland.	*Acacia colei* var. *colei* *Aristida hygrometrica* *Corymbia zygophylla* *Grewia pindanica* ***Corymbia paractia*** ***Jacquemontia* sp. Broome (A.A. Mitchell 3028)** ***Terminalia kumpaja***	QW01 QW02 QW03 QW04	220	

Unit	Description	Associated Species (Priority Species in Bold)	Quadrats	Area (ha)	Representative Photo
V002	*Brachychiton diversifolius* subsp. *diversifolius* low open woodland over, *Atalaya hemiglauca*, *Codonocarpus cotinifolius*, and *Grewia pindanica* mid sparse shrubland, over *Aristida holathera* var. latifolia sparse tussock grassland.	*Acacia platycarpa* *Bauhinia cunninghamii* *Triodia schinzii*	QW05	0	

3.5.2. Vegetation Condition

The Study Area was mapped as having Excellent (100%) vegetation condition. Weeds were rarely recorded in the Study Area.

3.6. Terrestrial Fauna

3.6.1. Fauna Habitats

The Study Area is dominated by Pindan shrubland habitats. This habitat type is the most common habitat across the local region and has been recorded across the Dampier Peninsula from several previous surveys (ecologia 2012b, 2012a, 2016; Ecoscape 2017).

The fauna assemblage of the Pindan shrubland includes mammal species such as the Northern Brown Bandicoot (*I. macrourus*), Agile Wallaby (*Macropus agilis*), Stripe-faced Dunnart (*Sminthopsis macroura*), and Delicate Mouse (*Pseudomys delicatulus*). Bat species such as the Gould's Wattled Bat (*Chalinolobus gouldii*) and Northern Freetail Bat (*Chaerophon jobensis*) often forage insects from between the shrubs and trees.

A wide variety of bird species are associated with this habitat and occur in different seasons and at varying densities depending on local conditions and resource availability. Common species (Singing Honeyeater, Brown Honeyeater, Rufous-throated Honeyeater, Grey-crowned Babbler, Rufous Whistler, Crested Bellbird, Jacky Winter and Zebra Finch) forage amongst the sparse canopy of the *Corymbia* spp., *Eucalyptus* spp. Ground foraging species (Emu, Crested Pigeon, Brown Quail, Bar-shouldered Dove, Peaceful Dove and Diamond Dove) utilise fallen seed and annual herb resources which can result in large fluctuations in response to rainfall and associated increased plant growth. Predatory raptor species (Brahminy Kite, Whistling Kite, Black Kite, Nankeen Kestrel, Brown Goshawk and Square-tailed kite) are also frequently seen hunting across this landscape.

Reptile species associated with the Pindan shrubland include ground-dwelling goannas (*Varanus brevicauda* and *V. gouldii*), dragons (*Diporiphora pindan*, *Pogona minor*, *Chlamydosaurus kingii*, and *Amphibolurus gilberti*), legless lizards (*Lialis burtoni*, *Pygopus steelescotti* and *Delma tincta*), ground-welling geckos such as *Lucasium stenodactylum*, and arboreal geckos such as *Strophurus ciliaris* which utilise the *Acacia* shrubs. A number of skinks are also found in the Pindan shrubland, including (*Carlia munda*, *Eremiascincus isolepis*, *Lerista griffini*, *Morethia storri*, *Proablepharus tenuis*, *Tiliqua scincoides*).

This habitat is also suitable for a range of conservation significant fauna species, including ground-dwelling species that forage in the grassland such as the Greater Bilby (*Macrotis lagotis*), Golden Bandicoot (*Isoodon auratus auratus*), Dampier Peninsula Goanna (*Varanus sparnus*) and Spectacled Hare-wallaby (*Lagorchestes*

conspicillatus leichardti), and species foraging between the foliage of trees and shrubs such as the Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudiclunoatus*).

3.6.2. Conservation Significant Fauna

Results of the literature review identified 33 conservation significant fauna species (12 mammal, 15 bird and 6 reptile species). An additional 61 conservation significant bird species and two mammal species that are associated with marine, shoreline and wetland environments were also identified however due to the location of the Study Area and a lack of water bodies, these species have been excluded from the assessment.

Of the 33 species of conservation significance potentially occurring within the Study Area, 15 species have a Medium to High likelihood of occurrence. The remaining 19 species have a Low or Very Low likelihood to utilise the habitats within the Study Area.

4. TEN PRINCIPLES FOR CLEARING NATIVE VEGETATION

Schedule 5 of the *Environmental Protection Act 1986* (As at 30 Jun 2021) stipulates ten clearing principles to be followed when determining impacts to native vegetation. An assessment on how the proposed vegetation clearing within the Study Area relative to the principles and the Guideline document *'A guide to the assessment of applications to clear native vegetation'* (DER 2014) is present below in Table 4.1

Table 4.1: 10 Native Vegetation Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	It comprises a high level of biodiversity.	The Development Footprint occurs entirely within one Beard vegetation sub-association (750.1) which is restricted to the Dampierland IBRA region but is the second largest sub-association within the region and as such is considered widespread with 99.7% of its pre-European extant remaining. ***Flora*** There was one vegetation type identified within the Development Footprint derived from flat Pindan Plains. There were 127 taxa from 39 families and 93 genera recorded during the survey of the Study Area. The proportion of flora collected was consistent with expectations for this type of survey and survey timing in the context of other surveys of a similar level and seasonality. The Development Footprint intersects two PEC's: Mangarr (Minyjuru) PEC (buffer) falls within the northwest of the Development Footprint, with a proposed impact of 3.27 hectares to the buffer, and the *Corymbia paractia* PEC, which is represented by the removal of two records of *C. paractia* recorded within the Development Footprint. Although the two PEC's are impacted the occurrence of these PEC's is not considered a significant occurrence within the landscape context. ***Protected Ecological Community*** The Mangarr (Minyjuru) PEC is described as "relict dune system dominated by extensive stands of Minyjuru (Mangarr - Sersalisia sericea)". The Mangarr PEC was previously recorded in the north-west corner of the Study Area (Talis Figure 02.). During the survey, *Sersalisia sericea* trees were targeted during the 100 m spaced traverses and six trees were recorded outside the current PEC boundary in the north-west corner; however, it is unlikely these trees represent the Mangarr PEC based on previous surveys of the Study Area. The *Corymbia paractia* PEC is described as "*Corymbia paractia* dominated community on dunes". The Study Area vegetation can be described as "transition zone between coastal vine thickets and Pindan vegetation" which is where the Corymbia paractia PEC occurs. *Corymbia paractia* trees were recorded within the Study Area (Talis Figure 02.). The Study Area likely contains the *Corymbia paractia* PEC given the distribution of the species in the surrounding area, abundance of the species, the presence of associated vegetation, and existing protections placed on individuals in the township of Broome.	The Proposal at the Study Area is **not** at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
		Fauna The literature review and database search identified 15 amphibians, 316 birds, 46 native mammals, ten introduced mammals and 92 reptile species that could occur within the regions surrounding the Development Footprint. Of those, 33 species of conservation significance may occur within, and 15 species have a Medium to High likelihood of occurrence. The remaining 19 species have a Low or Very Low likelihood to utilise the habitats within the Study Area. Systematic trapping and opportunistic foraging identified a total of 30 vertebrate fauna species within the Development Footprint (ten bird species, three non-volant mammal species (three introduced), three bat species, and fourteen reptile species). The DBCA priority 1 listed Northern Coastal Free-tailed Bat (*Ozimops cobourgianus*) was detected on multiple occasions within the Development Footprint. The Pindan shrubland habitat that occurs in the Development Footprint is homogenous and the microhabitats present are not likely to support short range endemic invertebrate species. Overall, the Pindan Shrubland habitat recorded from within occurs across a large continuous extent across the Dampier Peninsula, which indicates that there is a Low likelihood that the habitat within the Development Footprint supports any taxa with a distribution restricted to the Development Footprint. Variance to this principle is considered unlikely due to a consistent relative biodiversity within the broader landscape. The presence of PEC's in conjunction with flora and fauna diversity recorded within the Study Area has been considered, however the PEC extent and population size of priority species is not considered significant in this instance. As such, the site is not considered to represent a high level of biodiversity.	
(b)	It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna	The Development Footprint is dominated by Pindan Shrubland habitats. This habitat type is the most common habitat type across the local region and has been recorded across the Dampier Peninsula from several previous surveys (ecologia 2012b, 2012a, 2016a; Ecoscape 2017). Thirty-three conservation significant fauna species (12 mammal, 15 bird, and 6 reptile species) were identified in the desktop assessment and have potential to occur within the Development Footprint. Of the 33 conservation significant species, one species (Northern Coastal Free tailed Bat (P1) was recorded within the Development Footprint, four species have a high likelihood and 10 have a medium likelihood of occurrence within the Development Footprint (Spectrum Ecology 2020b). The recorded species and those with a medium-high likelihood are listed below: **EPBC Act listed:** - **Greater Bilby** *Macrotis lagotis* (High); - **Golden Bandicoot** *Isoodon auratus auratus* (Medium); - **Bare-rumped Sheathtail Bat** *Saccolaimus saccolaimus nudicluniatus* (High); - **Gouldian Finch** *Erythrura gouldiae* (Medium); - **Oriental Pratincole** *Glareola maldivarum* (High); - **Fork-tailed** Swift *Apus pacificus* (High);	The Proposal at the Study Area **is not** at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
		- **Oriental Cuckoo** *Cuculus optatus* (Medium); - **Barn Swallow** *Hirundo rustica* (Medium); **BC Act listed** - **Northern Brushtail Possum** *Trichosurus vulpecula arnhemensis* (Medium); - **Grey Falcon** *Falco hypoleucos* (Medium); - **Peregrine Falcon** *Falco peregrinus* (Medium); **DBCA (Priority)** - **Northern Coastal Free tailed Bat** *Ozimops (Mormopterus) cobourgianus* (Recorded); - **Spectacled Hare-wallaby** *Lagorchestes conspicillatus leichardti* (Medium); - **Short-tailed Mouse** *Leggadina lakedownensis* (Medium); and, - **Dampierland Peninsula** *Goanna Varanus sparnus* (Medium). Clearing within the Development Footprint is only likely to impact small areas of habitat for each species and is therefore not likely to impact the species or their survival. Some habitat is likely to be impacted for Spectacled Hare-Wallaby and Greater Bilby, but this is not considered significant in a landscape context as the Pindan Shrubland is widespread throughout the region. The Northern Coastal Freetail Bat was recorded during systematic surveys; however the Development Footprint does not provide roosting habitat for this species and the impact on foraging habitat is not considered significant.	
(c)	It includes, or is necessary for the continued existence of, threatened flora.	No Threatened Flora were recorded in the reconnaissance or detailed survey within the Development Footprint. One Threatened Flora species, *Seringia exastia,* was identified in the database searches located 9 kilometres south-west of the Study Area. This species was considered to have a medium likelihood of occurrence, however, it was not recorded during the exhaustive detailed and targeted assessment. This Threatened species, however, is in the process of being reclassified to a non -Threatened or Priority species and is common throughout Western Australia. Nineteen Priority Flora were recorded in the desktop assessment, *Aphyllodium glossocarpum* (P3), *Glycine pindanica* (P3), and *Polymeria* sp. Broome (P3) were considered to have a high likelihood of occurrence at the Development Footprint. *Aphyllodium glossocarpum* (Priority 3) was assigned a 'High' likelihood of occurring within the Study Area, including the Development Footprint, in the desktop assessment. This species was ranked as having a High local significance if it were to be found at the Study Area, as it is known from only two previous records around Broome, which was it was reported as the sole individual when collected. Given the effort of the current survey, it is unlikely that this species occurs in the Development Footprint. While maybe rare or under-collected in the Broome area, the species is known from records north to Dampier Peninsula and in the Shire of Wyndham-East Kimberley, and for this reason is considered to have a Low regional significance.	The Proposal at the Study Area is **not** at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
		Three priority flora species were recorded within the Development Footprint; 8 *Corymbia paractia* (P1) individuals, 31 *Jacquemontia* sp. Broome (P1) individuals, and 18 *Terminalia kumpaja* (P3) individuals. However, given the low number of priority flora individuals recorded within, and the landscape context, the populations are not considered significant. Although the Development Footprint includes conservation significant flora and has appropriate habitat for conservation significant flora, clearing of the Study Area is unlikely to threaten the continued existence of the recorded Priority Flora and other Priority Flora with High Likelihood of occurrence. Vegetation at the Study Area is not necessary for the continued existence of conservation significant flora.	
(d)	It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	No Threatened Ecological Communities were recorded within the Development Footprint. One federally listed TEC (State listed Vulnerable) was identified from the database searches, Monsoon vine thicket. An additional listed, Vulnerable Threatened Ecological Community, Roebuck Bay mudflats was identified form the database searches. These ecological communities are associated with riparian vegetation and do not resemble any vegetation communities within the Development Footprint. Native vegetation at the Development Footprint does not comprise the whole or part of, or is necessary for the maintenance of a TEC. As such, impacts within the Study Area is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.
(e)	It is significant as a remnant of native vegetation in an area that has been extensively cleared	The Development Footprint is 100% comprised of the 750.1 Beard vegetation unit. The vegetation unit is widespread and 99.7% of its pre-European extent remains. The Development Footprint represents a small fraction of the vegetation unit. The vegetation within the Development Footprint is not significant as the vegetation unit has not been extensively cleared. As such, impacts within the Development Footprint is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.
(f)	It is growing in, or in association with, an environment associated with a watercourse or wetland	No nationally significant wetlands, including Ramsar wetlands or watercourses were located within the Development Footprint. The Development Footprint occurs 1 km north of the buffer surrounding the Roebuck Bay Mudflats; Species-rich faunal community of the intertidal mudflats of Roebuck Bay. As such, impacts within the Development Footprint is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.
(g)	The clearing of the vegetation is likely to cause appreciable land degradation.	The total area to be cleared within the Development Footprint is 69.02 ha. Considering the small area proposed to be cleared, the history of minimal land clearing in the area and existing vegetation condition, it is unlikely that the proposed clearing will cause appreciable land degradation. As such, impacts within the Development Footprint is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.

Principle Number	Principle	Assessment	Outcome
(h)	The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	One conservation area, Yawuru Birragun Conservation Park (WA_52354) is adjacent and directly west of the Development Footprint. Clearing of native vegetation within the Development Footprint is unlikely to impact the environmental values of this area. Impacts within the Development Footprint is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.
(i)	The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The proposed clearing of native vegetation within the Development Footprint is not expected to cause deterioration in the quality of surface or underground water. Further site investigation works including hydrological surveys will provide more information as the project matures.	The Proposal at the Study Area is **unlikely** to be at variance to this Principle.
(j)	The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The vegetation proposed to be cleared at the Development Footprint is small and are not expected to cause or exacerbate the instance of flooding. As such, impacts within the Development Footprint is not at variance to this principle.	The Proposal at the Study Area is **not** at variance to this Principle.

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