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Baseline flora and vegetation survey for the Port Hedland Solar Farm Project

Prepared for Alinta Energy

December 2021

Draft

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Prepared for Alinta Energy

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Phoenix Environmental Sciences Pty Ltd

2/3 King Edward Road OSBORNE PARK WA 6017

P: 08 6323 5410

E: admin@phoenixenv.com.au

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EXECUTIVE SUMMARY

Alinta Energy engaged Phoenix Environmental Sciences Pty Ltd to undertake a detailed flora and vegetation survey for the proposed Port Hedland Solar Farm Project (the Project), located 3.5 km to the south-west of South Hedland in the Pilbara bioregion, Western Australia.

The scope of work included undertaking a desktop assessment to identify potential significant species and communities within the Project to be followed by a two-season detailed field survey to describe and map vegetation types and condition and conduct targeted searches for significant flora and vegetation. The desktop assessment was completed prior to the field survey which were conducted in March (Autumn) 2021 and September (Spring) 2021.

The desktop assessment identified 14 significant flora comprised of one Threatened flora and 13 Priority flora that may occur in the Project, there were not previous records of any of the species within the study area. One state listed Priority Ecological Community occurred 38 km to the north of the Project, no significant vegetation intercepted the Project area.

The field surveys recorded 146 flora taxa representing 38 families and 88 genera within the Project. The assemblage included 140 native species and six introduced species (none were a Declared Pest of Weed of National Significance), including 92 perennial species, and 54 annual or short-lived species. The most prominent families were Poaceae (29 species), Fabaceae (20 species), Malvaceae (14 species), Convolvulaceae (13 species) and Cyperaceae (10 species).

No Threatened or priority flora were recorded in the Project however it was considered possible that eight significant flora identified in the desktop assessment may occur within the Project. A solitary plant of an undescribed species, *Phyllanthus* sp. Port Hedland Solar Farm, was recorded within the Project and as a potential new/undescribed species was considered to represent a locally significant taxon. This specimen collected is considered to represent *Phyllanthus* sp. B Kimberley Flora and three undescribed *Phyllanthus* specimens housed at the state herbarium recorded in the Kimberley, Pilbara and Great Sandy regions.

The Threatened species *Seringia exastia* was determined to possibly occur within the Project. *Seringia exastia* (CR) is due to have its conservation status removed after a recent taxonomic study assessed discovered *S. exastia* to be synonymous with *S. elliptica* a common and widespread species. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required. Of the remaining seven Priority flora identified to potentially occur in the study area, six have 21 or more records and/or occur across several bioregions and subregions and/or have large populations records. Subsequently any records of the species within the study area are unlikely to represent a substantial proportion of the total population for the species. *Gomphrena leptophylla* (P3), is only known from eight records with small population sizes and subsequently, any plants within the study area may represent a reasonable proportion of the total population of the species.

The majority of the vegetation in the Project was representative of a broad vegetation association with over 99% of pre-European extent remaining and thereby considered of Least Concern. None of the vegetation was considered to represent the PEC identified in the desktop assessment. Two vegetation types recorded within the Project were considered locally significant due to restricted distribution, a tussock grassland/forbland associated with small claypans and riparian vegetation of the single creek system within the Project. As both vegetation types occupy only a small area it may be possible to avoid them during development.

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1 INTRODUCTION

Alinta Energy (AE) is seeking to develop the Port Hedland Solar Farm Project (PSF, the Project), located 3.5 km to the south-west of South Hedland in the Pilbara bioregion, Western Australia (WA; Figure 1-1).

In January 2021, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by AE to undertake a detailed flora and vegetation survey for the Project.

The purpose of the surveys were to define the flora values of the PSF study area to inform Project planning and environmental impact assessment processes. The results of the surveys will ultimately determine if environmental approvals (Environment Protection and Biodiversity Conservation Act (EPBC Act) approval and Environmental Protection Act 1986 (EP Act) -Part IV) are required for the Project.

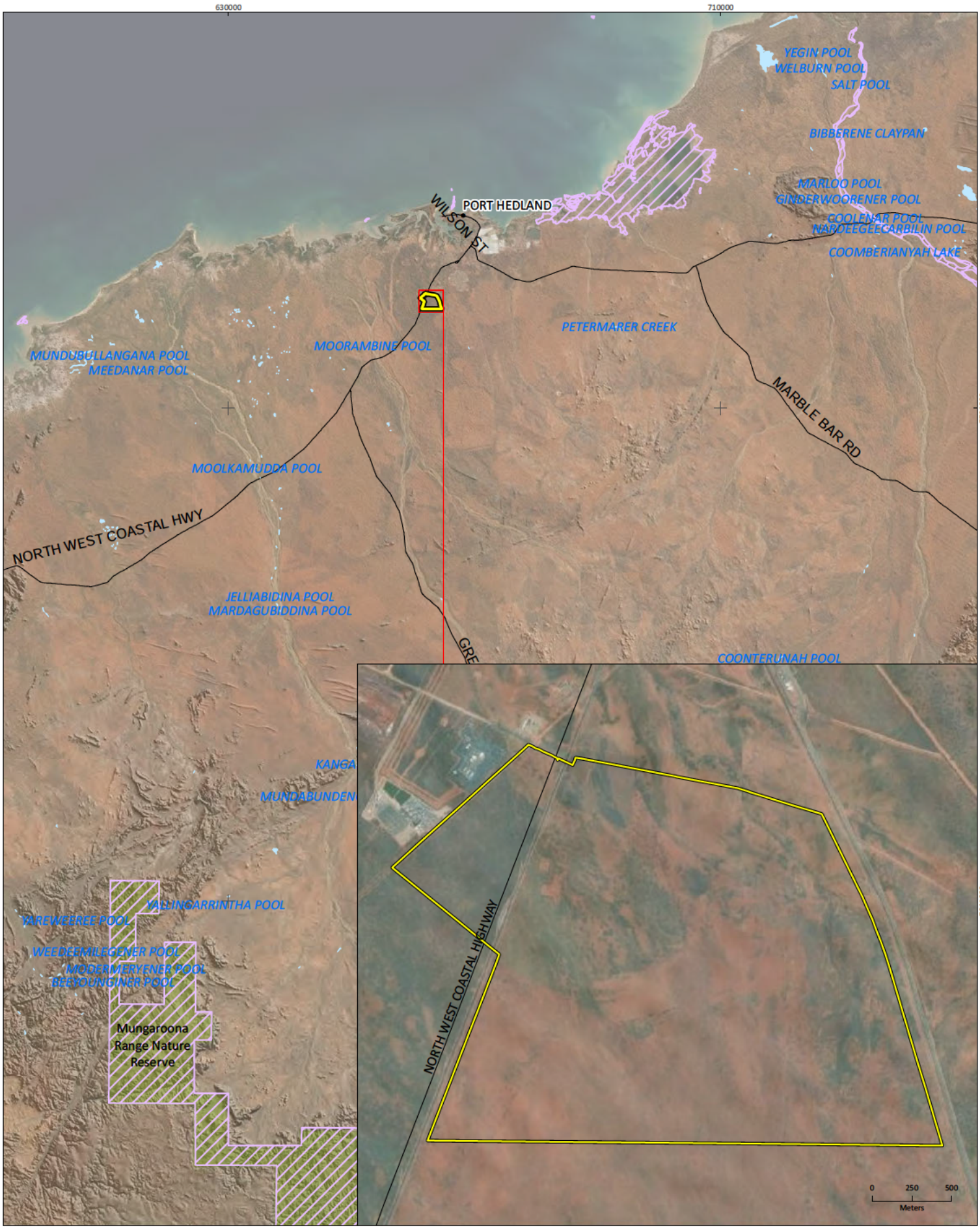
1.1 SCOPE OF WORK

The scope of work for the detailed flora and vegetation survey was as follows:

- conduct a flora and vegetation desktop assessment to identify potential conservation significant species and communities located in the study area (Figure 2-1).
- undertake a detailed flora and vegetation survey in the study area that includes:
    - consideration of the optimal survey timing for the botanical province
    - survey in the Primary survey period for the bioregion and supplementary survey if required
    - multiple quadrats located at representative points throughout each vegetation type to describe the representative flora and vegetation of the study area
    - targeted searches for significant flora and vegetation
- prepare a technical report on the findings of the surveys.

1.2 STUDY AREA

The study area (approximately 670.37 ha) is situated between the existing Alinta Port Hedland power station (western boundary) and FMGs Cloudbreak to Port Hedland rail (eastern boundary) and dissected by the Great Northern Hwy approximately 8 km south of South Hedland (Figure 1-1).



Alinta Energy Pty Ltd via Preston Consulting
Port Hedland Solar Farm Project

Project No	1387
Date	21/07/2021
Drawn by	IN
Map author	GW

0 10 20
Kilometers

1 800,000(at A4) GDA 1994 MGA Zone 50

- Study area
- Environmentally sensitive areas
- Lake
- DBCA managed land
- Road

Figure 1-1

Project location and study area

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2 LEGISLATIVE CONTEXT

The protection of flora and fauna in WA is principally governed by three acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

The BC Act came into full effect on 1 January 2019 and replaced the functions of the *Wildlife Conservation Act 1950* (WC Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of the Environment and Energy (DEE). The EPBC Act provides for the listing of Threatened flora and Threatened Ecological Communities (TECs) as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process.

Conservation categories applicable to Threatened flora species under the EPBC Act are as follows:

- Extinct (EX)[1] – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)[1] – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English & Blyth 1997). There are three categories under which ecological communities can be listed as TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

2.2 STATE

2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened flora species (Government of Western Australia 2018a, b)[2] in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future[3]

[1] Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

[2] The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act.

[3] As determined in accordance with criteria set out in the ministerial guidelines.

- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future[3]
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium term future[3].

Species may also be listed as specially protected (SP) under the BC Act in one or more of the following categories:

- species of special conservation interest (conservation dependent fauna, CD) – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- migratory species (Mig.), including birds subject to international agreement
- species otherwise in need of special protection (OS).

The Department of Biodiversity, Conservation and Attractions (DBCA) administers the BC Act and also maintains a non-statutory list of Priority flora. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora lists are assigned to one of four Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a TEC and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Threatened and Priority Ecological Communities

The BC Act provides for the listing of TECs in the following categories:

- Critically Endangered – facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future[3]
- Endangered – facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future[3]
- Vulnerable – facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium term future[3].

An ecological community may be listed as a collapsed ecological community under the BC Act if there is no reasonable doubt that the last occurrence of the ecological community has collapsed or the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure.

The DBCA also maintains a non-statutory list of Priority Ecological Communities (PECs), which may become TECs in the future; however, do not currently meet survey criteria or that are not adequately defined. PECs are assigned to one of five categories depending on their priority for survey or definition, with Priority 1 of highest concern and Priority 5 of lowest concern.

2.2.4 Other significant flora and vegetation

Under the EPA's environmental factor guidelines, flora and vegetation may be considered significant for a range of reasons other than listing as a Threatened or Priority species or ecological community.

In addition to listing as Threatened or Priority, EPA (2016a) identifies the following:

- flora may be significant for
    - local endemism 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
  - representing the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
  - being unusual species, including restricted subspecies, varieties or naturally occurring hybrids
  - having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape
- vegetation may be significant for:
  - having restricted distribution
  - subject to a degree of historical impact from threatening processes
  - having a role as a refuge
  - providing an important function required to maintain ecological integrity of a significant ecosystem.

Provided in the guide for assessment of applications to clear native vegetation (DER 2014) is a scale for assessing the bioregional conservation status of ecological vegetation classes (Table 2-1).

Table 2-1 Bioregional conservation status of ecological vegetation classes

Conservation status	Description
Presumed extinct	Probably no longer present in the bioregion
Endangered*	Less than 10% of pre-European extent remains
Vulnerable*	10-30% of pre-European extent exists
Depleted*	More than 30% and up to 50% pre-European extent exists
Least concern	More than 50% of pre-European extent exists and subject to little or no degradation over a majority of this area

*or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

2.2.5 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be ESAs. ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

ESAs are areas where the vegetation has high conservation value. Several types of areas are declared ESAs including:

- the area covered by vegetation within 50 metres (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 defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland
- Bush Forever sites.

2.2.6 Introduced flora

Introduced flora (weeds) pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing,

fire or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (AWC 2007).

Management of some weed species is required under Commonwealth or State frameworks. Key classifications for significant introduced flora that are relevant to this report are:

- Declared Pest – the Biosecurity and Agriculture Management Act 2007, Section 22 makes provision for a plant taxon to be listed as a Declared Pest organism in parts of, or the entire State. Under the Biosecurity and Agriculture Management Regulations 2013 Declared Pests are assigned to one of three control categories that dictate the level of management required (DPIRD 2019).
- Weed of National Significance (WoNS) – high impact, established introduced flora causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012). Management is required in accordance with Department of Primary Industries and Regional Development (DPIRD) guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (*).

3 EXISTING ENVIRONMENT

3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into large 'bioregions' and 'subregions' based on climate, geology, landform, native vegetation and species information (DoEE 2016). The study area is located in the Roebourne (PIL4) subregion of the Pilbara bioregion (Figure 3-1) which is characterised as:

- Quaternary alluvial and older colluvial coastal and sub-coastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera*. Uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas.
- Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three.
- Climate is arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually (May & McKenzie 2003).

3.2 LAND SYSTEMS AND SURFACE GEOLOGY

DPIRD undertakes land system mapping for WA using a nesting soil-landscape mapping hierarchy (Schoknecht & Payne 2011). While the primary purpose of the mapping is to inform pastoral and agricultural land capability, it is also useful for informing biological assessments. Under this hierarchy, land systems are defined as areas with recurring patterns of landforms, soils, vegetation and drainage (Payne & Leighton 2004).

The study area intersects one land systems (Table 3-1; Figure 3-2).

Table 3-1 Land systems and extent in study area

Land system	Description	Area (ha)	% of study area
Uaroo System	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs.	670.37	100%

According to the Surface Geology of Australia 1:1,000,000 scale, WA database (Stewart *et al.* 2008), the study area intersects one geological formation (Table 3-2; Figure 3-2).

Table 3-2 Surface geology of the study area, extent by deposit type

Surface geology	Abbreviation	Description	Area (ha)	% of study area
Alluvium 38485	Qa	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted	670.37	100%

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Port Hedland Solar Farm Project

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Date	4/02/2021
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Map author	GW

0 5 10
Kilometers

1 250,000 (at A4) GDA 1994 MGA Zone 50

Study area

IBRA region and subregion

Pilbara, Chichester

Pilbara, Roebourne

Figure 3-1

Study area in relation to IBRA bioregions and subregions

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Map author	GW

0 1 2
Kilometers

1 80,000 (at A4) GDA 1994 MGA Zone 50

Study area

Land system
- Littoral System
- Mallina System
- River System
- Uaroo System

Surface geology
- Qa
- Qdc
- Qe
- Qtm
- water

Figure 3-2

Land systems and surface geology in the study area

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3.3 CLIMATE AND WEATHER

The climate of the Roebourne subregion is described as arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually (Kendrick & Stanley 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Port Hedland (no. 004032), Latitude: 20.37°S Longitude 118.63°E), located 8 km north-east of the study area.

Port Hedland records the highest mean maximum monthly temperature (36.7°C) in December (lowest in July, 27.3°C) and the lowest minimum mean monthly temperature (12.5°C) in July (highest in January, 25.6°C) (BoM 2021) (Figure 3-3). Average annual rainfall is 26.4 mm with December and February recording the highest monthly averages (94.2 and 103.2 mm respectively; Figure 3-3).

Daily mean temperatures at Port Hedland preceding the surveys show mean daily temperatures higher than long term averages. For the three months preceding the survey, daily mean temperatures were average to above long-term averages (Figure 3-3).

Port Hedland airport rainfall records were below long-term averages for most of the year preceding the first season survey (Figure 3-3), except during December and February – which were significantly above long-term averages due to two Tropical Lows (02U and 12U).

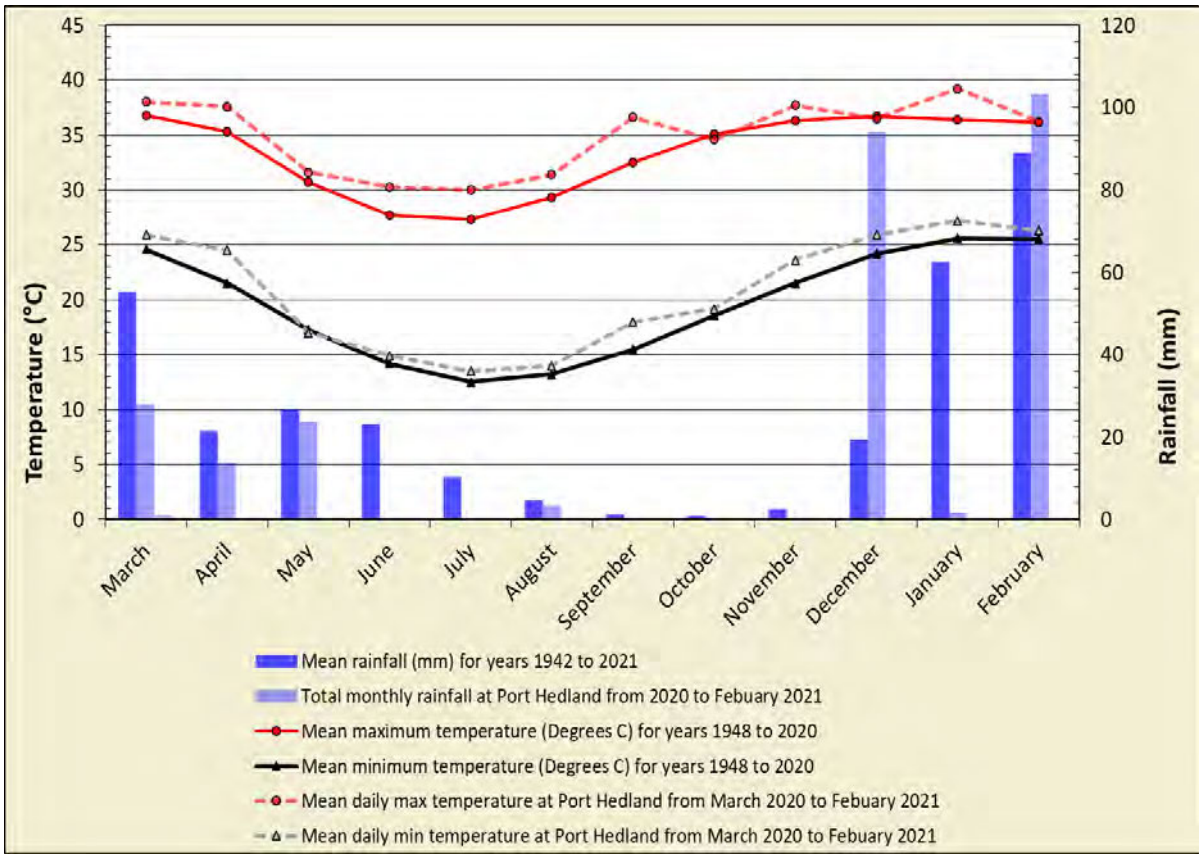


Figure 3-3 Annual climate and weather data for Port Hedland (no. 004032) and mean monthly data for the 12 months preceding the first season survey (BoM 2021)

Daily mean temperatures at Port Hedland preceding the second season survey were higher than average for most months. In the three months prior to the survey, mean temperatures were above historical averages.

Records from Port Hedland show rainfall levels leading up to the survey were below average for every month except in December (74.8mm above average), February (24.7mm above average) and June

(2.4mm above average). The total rainfall level in the 12 months prior to the survey (295.1mm) was 24.1mm less than the historical annual average (319.2mm). November and April experienced no rainfall. In the three months prior to the survey, there was a total of 2.6mm of rain.

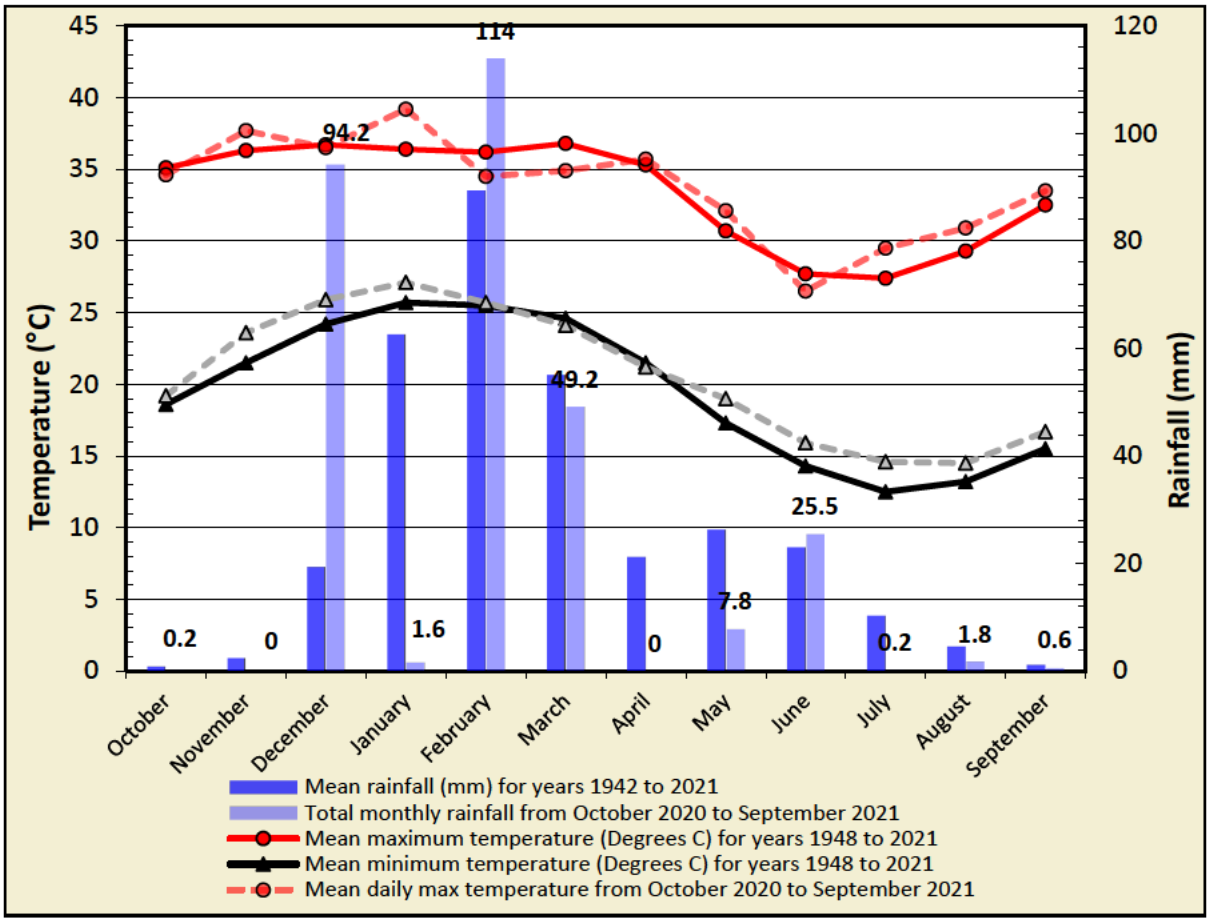


Figure 3-4 **Annual climate and weather data for Port Hedland (no. 004032) and mean monthly data for the 12 months preceding the second season survey (BoM 2021)**

3.4 LAND USE

The land use statistics are derived from the Australian Bureau of Agriculture and Resource Economics and Sciences' (ABARES) Catchment Scale Land Use Mapping for WA 2018 dataset (ABARES 2018), for the IBRA SWA2 sub-region. The dataset is a compilation derived from various vector datasets. The date (2008 to 2018) and scale (1:5,000 to 1:250,000) of each dataset, therefore, reflects the source data. Land use is classified according to the Australian Land Use and Management (ALUM) Classification (v8); a three-tiered hierarchical structure.

The majority of the study area is used for production from relatively natural environments (grazing native vegetation and residual native cover).

3.5 CONSERVATION RESERVES AND ESAS

The nearest conservation reserve is Mungaroona Range Nature Reserve, located approximately 95.2km SSW of the study area. Three ESAs are located 14 -17 km north and north-east of the approximate centre of the PHSF study area. One of these is located along the coast and the other two are on offshore islands. These are all under the Register of the National Estate (RNE), which is no longer a statutory list under the EPBC Act (Figure 1-1). From 2007, places could no longer be added to, or removed from, the RNE (Department of Agriculture 2020). RNE places can be however, protected under the EPBC Act if they are also included in another Commonwealth statutory heritage list or are owned or leased by the Commonwealth. RNE is used on a non-statutory basis as an educational resource and publicly available archive (Department of Agriculture 2020).

4 METHODS

The flora and vegetation survey was conducted in accordance with relevant survey guidelines and guidance, including:

- EPA Environmental Factor Guideline: Flora and vegetation (EPA 2016a)
- EPA Technical Guidance: Flora and vegetation surveys for Environmental Impact Assessment (EPA 2016b)

4.1 DESKTOP REVIEW

Searches of several biological databases were undertaken to identify and prepare lists of significant flora and vegetation that may occur within the study area (Table 4-1). A literature search was conducted for accessible reports for biological surveys conducted within 40 km of the study area to build on the lists developed from the database searches (Table 4-2).

Table 4-1 Database searches conducted for the desktop review

Database	Target group/s	Search coordinates and extent
Protected Matters Search Tool (Ref: PMST_URTX4Z)	EPBC Act Threatened flora and ecological communities	Approximate centre point of study area (118.56°S, 20.44°E) with 40 km buffer
DBCA Threatened and Priority Flora Database (Ref: 25-0121FL)	Threatened and Priority flora	Study area plus a 40 km buffer
DBCA Threatened and Priority Ecological Communities Database (Ref:14-0221EC)	TECs and PECs	Study area plus a 40 km buffer
DBCA NatureMap Database	Flora records	Study area plus a 40 km buffer

Table 4-2 Survey reports included in the desktop review

Report author	Survey description	Project
ENV (2011)	Level 2 Flora and vegetation assessment	Port Hedland regional area
Emerge Associates (2019)	Reconnaissance Flora and vegetation assessment	Port Hedland airport highway precinct 2
GHD (2016)	Reconnaissance Flora and vegetation assessment	Roy Hill port facility

4.2 FIELD SURVEY

4.2.1 Survey timing

Field survey dates are provided in Table 4-3.

Table 4-3 Survey dates

Survey type	Season	Dates
Flora and vegetation detailed survey, phase 1	Autumn	23rd - 26th March 2021
Flora and vegetation detailed survey, phase 2	Spring	14th – 15th September

4.2.2 Flora and vegetation

Field methods for the flora and vegetation survey of the study area included:

- surveying of quadrats and relevés (see 4.2.2.1)
- targeted flora searches (4.2.2.2)
- vegetation type and condition mapping (4.2.2.3, 4.2.2.4, 4.2.2.6)
- TEC/PEC assessment (4.2.2.5).

Prior to the commencement of the field survey, data including satellite imagery, survey boundary, and pre-selected vegetation survey sites were loaded onto electronic field devices. The field survey involved assessing and mapping vegetation boundaries, conducting quadrat and relevé sampling and collecting opportunistic flora specimens. GPS locations of vegetation and condition boundaries, survey sites and flora specimen data were recorded digitally.

4.2.2.1 Quadrats and relevés

Quadrat locations were selected to ensure that an accurate representation of the major vegetation types within the study area were sampled adequately, with a minimum of at least three quadrats per vegetation type. Two methods were used for the selection of quadrat placement within the study area. Preliminary quadrat locations were pre-selected using aerial photography, with selection based on apparent changes in the vegetation visible in the aerial imagery. Final quadrat placement was determined in the field while ground-truthing the study area on foot. Some preliminary quadrats were moved to locations which better represented vegetation types and some quadrats were changed to relevés, where only dominant vegetation was recorded for the purposes of accurate vegetation mapping.

In total, 19 quadrats (50 m x 50 m) and 11 relevés were surveyed across the study area (Figure 4-1; Appendix 1).

Quadrat sampling dimensions were 50 m x 50 m in accordance with EPA guidance for the Eremaean Botanical Province. The following information was recorded for each quadrat (Appendix 2):

- location – the geographic coordinates of all four corners of the quadrat in WGS84 projection
- description of vegetation – a broad description utilising the structural formation and height classes based on National Vegetation Information System (ESCAVI 2003) and in accordance with EPA (2016b) (Appendix 3)
- habitat – a brief description of landform and habitat
- geology – a broad description of surface soil type and rock type
- disturbance history – a description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance, human activity and fauna activity
- vegetation condition – using the condition scale in EPA (2016b) for the Eremaean Botanical Province
- height and percentage foliage cover (PFC) – a visual estimate of cover of total vegetation cover, cover of shrubs and trees >2 m tall, cover of shrubs <2 m, total grass cover and total herb cover
- photograph – a colour photograph of the vegetation within each quadrat in a south-easterly direction from the north-west corner of the quadrat
- flora species list – comprehensive list of all flora species recorded within the quadrat.

To ensure accurate taxonomic identification of flora species present within the study area, collections were made of each specimen at least once and each collection was pressed and documented for identification using the WA Herbarium resources.

For each species identified, records on FloraBase and the Australasian Virtual Herbarium were consulted to provide information on known ranges to determine whether the study area represented a range extension for the species.

At three locations (SF034-036) an apparent unique vegetation type occurred in small low-lying depressions that were less than 50 x 50 m in size. At these locations an unbounded relevé survey was conducted with all data recorded as for a quadrat survey.

All remaining relevés were sampled within vegetation units where dominant species, soils and topography were representative of vegetation surveyed in quadrats. Information collected in relevés was the same as for quadrats with the exception that:

- only a single geographic coordinate was recorded
- only prominent flora species were recorded.

4.2.2.2 Targeted flora searches

During the initial survey targeted searches were undertaken for significant flora (Threatened and Priority), Declared Pests and WoNS. Remnant vegetation was traversed by foot in meandering transects with the searches focused on habitats considered likely to support significant flora.

If a flora species was considered to potentially be a significant species (i.e. similar floristic characteristics and occurring within suitable habitat) the following information was collected:

- GPS coordinates, including population boundary where applicable
- description of the habitat and floristic community in which the potential significant species was located
- population size estimate (i.e. estimated number of individual plants) where applicable
- specimen collection for taxonomic identification and lodgement at the WA Herbarium
- photograph of live plant in situ and description of important details, such as flower colour, height of individual or average height of population.

In the second season survey records of all significant flora identified during the initial survey were revisited and the surrounding area searched to ensure populations size and distribution were accurately determined.

Following the field survey, the likelihood of occurrence for each significant flora species identified in the desktop review was assessed and assigned to one of three ratings:

- recorded – species recorded within the study area by previous or current survey
- possible – study area within known range of species; potential habitat within the study area, records within 5 km of study area and may not have been detectible during survey (e.g. survey conducted outside flowering period, annual plant survey conducted outside likely period of occurrence, small herbaceous plant in dense vegetation), or entire area of habitat not thoroughly searched
- unlikely – study area outside known range of species and/or no suitable habitat present in study area and/or suitable/potential habitat present but study area considered adequately searched for the species.

4.2.2.3 Vegetation type mapping

Vegetation mapping was undertaken at a scale of 1:10,000 using NVIS sub-association level (L5) for structural descriptions (ESCAVI 2003). The vegetation descriptions from quadrats and relevés from the survey were grouped according to similarity of community structure (i.e. canopy levels), species composition and combination of species and the prevalent community structure (i.e. woodland,

shrubland, etc.). The vegetation boundaries were mapped utilising ArcGIS ESRI imagery and from vegetation boundaries recorded on GPS during the field survey.

To support delineation of vegetation types, a cluster analysis was conducted based on species presence in each quadrat. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). A dendrogram was produced to illustrate the similarities between the vegetation units identified. Statistically distinct vegetation units (the floristic group) classified the vegetation at a local scale. Local scale vegetation units were described at NVIS Level V – Association (ESCAVI 2003). The term 'vegetation type' was used for local scale vegetation units in accordance with EPA technical guidance (EPA 2016b).

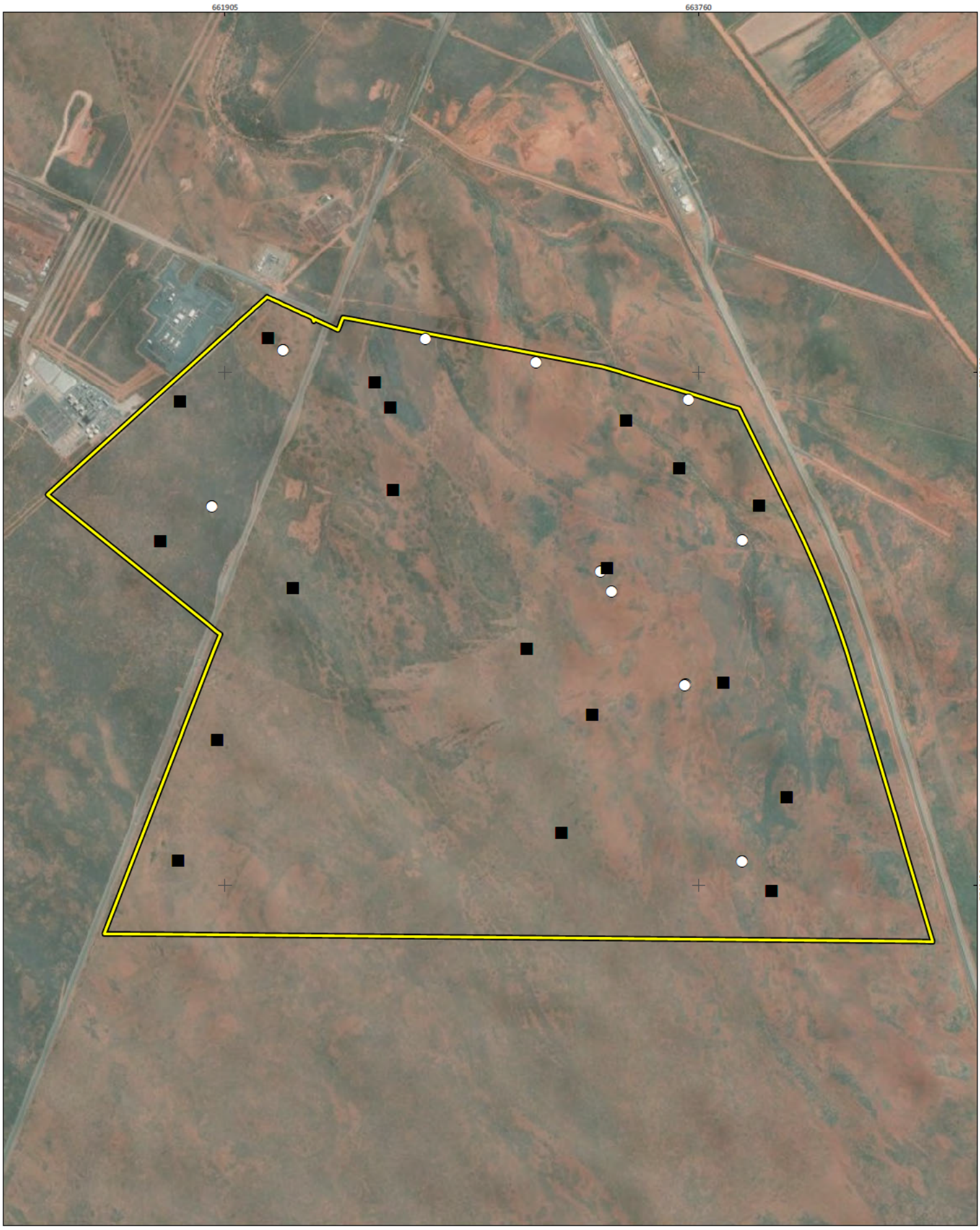
Preliminary vegetation type and condition maps were completed prior to the second season survey and uploaded onto electronic field devices for ground truthing in the field.

4.2.2.4 Vegetation condition mapping

The condition of vegetation was mapped across the study area based on the appropriate condition scale for the Eremaean Botanical Province (Keighery 1994 in EPA 2016b) (Table 4-4). The vegetation condition ratings relate to vegetation structure, the level of disturbance and weed cover at each structural layer and the ability of the vegetation unit to regenerate. Vegetation condition ranges from Excellent being the highest rating to Completely Degraded as the lowest.

Table 4-4 Vegetation condition rating scale (EPA 2016b)

Condition rating	Description
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.



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Date	3/12/2021
Drawn by	IN
Map author	GW

0 250 500
Meters

1 19,300 (at A4) GDA 1994 MGA Zone 50

Study area

Site

- Quadrat
- Relevé

Figure 4-1

Flora and vegetation survey sites

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4.2.3 Survey personnel

The personnel involved in the surveys are listed in Table 4-6. All survey work was carried out under relevant licences issued by DBCA under the BC Act (Table 4-6).

Table 4-5 Survey personnel

Name	Permit	Qualifications	Role/s
Dr Grant Wells	FB62000227 TFL103-1920	PhD Botany	Field survey, taxonomy, reporting
Dr Grace Wells	NA	PhD Botany	GIS, Mapping
Calum Woods	TFL 36-2021	MSc (Cons. Biol)	Field survey, data analysis
Shenade Findlay	Flora taking (biological assessment licence) FB62000173	BSc (Wildlife & Cons. Biol.); Ma (Cons. Biol.)	Reporting
Dr Andrew Perkins	Flora taking (biological assessment licence) FB62000181	PhD (Botany), BSc (Hons)	Taxonomy

5 RESULTS

5.1 DESKTOP REVIEW

5.1.1 Flora and vegetation

5.1.1.1 Flora assemblage

The desktop review identified records of 474 flora taxa within the desktop search extent (502 654 Ha), comprising of 63 families and 199 genera. The assemblage included 431 native species and 43 introduced flora. The most prominent families were Fabaceae (92), Poaceae (81), Malvaceae (28), Amaranthaceae (28) and Cyperaceae (23).

A regional survey of the Port Hedland area (ENV 2011) that covered 80 874 Ha recorded 388 taxa from 55 families and 152 genera with 326 native species and 12 introduced flora. The most prominent families were Fabaceae (71), Poaceae (51), Malvaceae (29), Amaranthaceae (18) and Cyperaceae (15). Species richness in the 50 x 50 m quadrats ranged from one to 49. No Declared Pests or WoNS were recorded during the survey but two Declared Pests **Opuntia stricta* and **Tamarix aphylla* were identified in the desktop assessment.

A reconnaissance survey of an area of the Port Hedland airport (Emerge Associates 2019) covered 37.99 Ha and recorded 43 species representing 16 Families and 31 genera with 38 native species and five introduced flora. The most prominent families were Poaceae (9), Fabaceae (6) Amaranthaceae (5) and Asteraceae (4). One Declared Pest **Calotropis procera* was recorded.

A reconnaissance survey of a port facility (GHD 2016) covered 27.13 Ha and recorded 28 species from 15 families and 23 genera with 25 native species and three introduced flora. The most prominent families were Poaceae (6), Fabaceae (5) and Chenopodiaceae (4). No Declared Pests or WoNS were recorded.

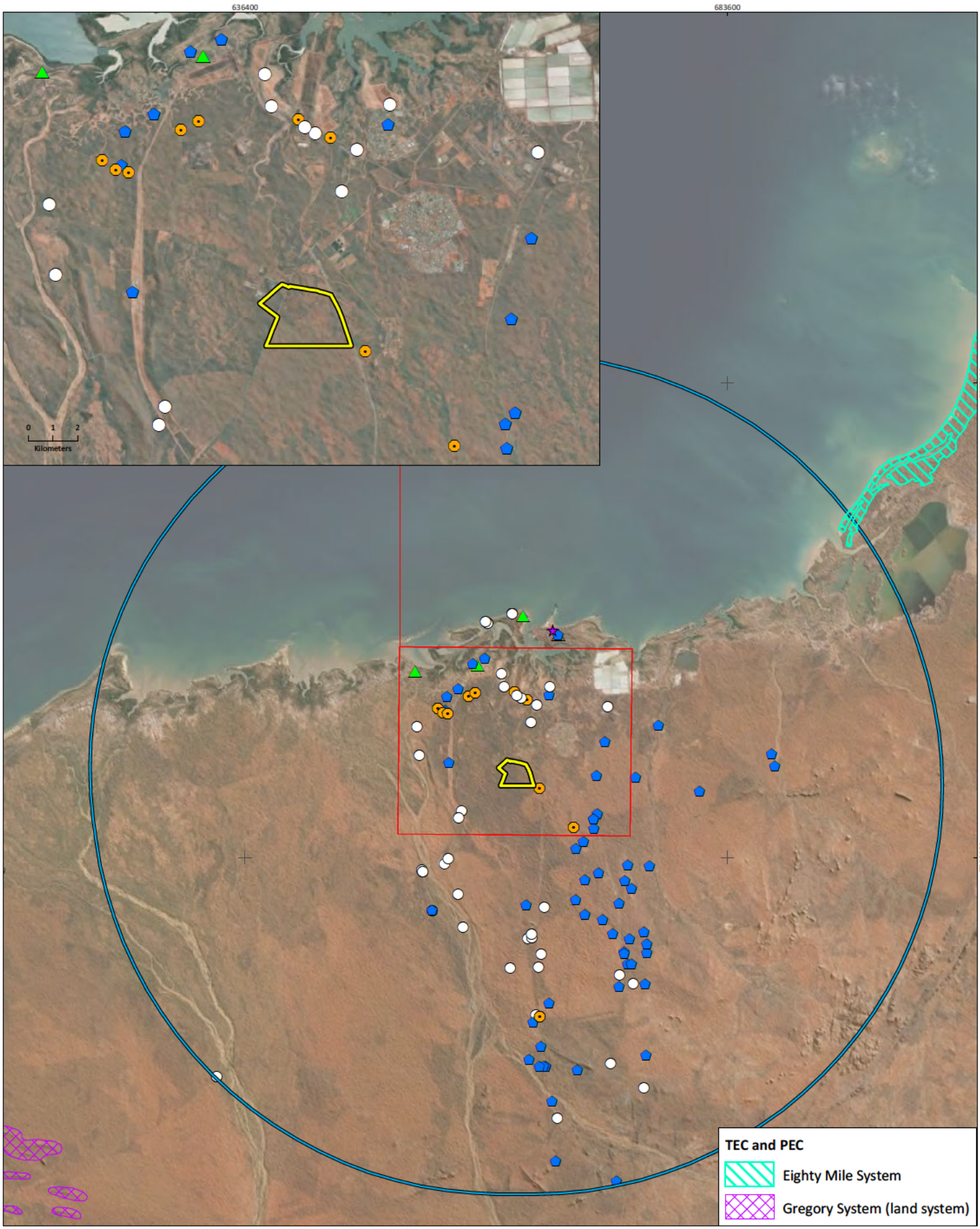
5.1.1.2 Significant flora

Records of 14 significant flora species were identified within the desktop search extent, comprising one Threatened flora listed under the EPBC Act and/or BC Act and 13 Priority flora (Table 5-1). None of these records of significant flora occurred in the study area (Figure 5-1).

Table 5-1 Significant flora identified in the desktop review

Species	Status	Proximity to study area	Habitat
Abutilon sp. *Pritzelianum* (S. van Leeuwen 5095)	P3 (DBCA)	4.6 km SW of study area	Grows in shrublands of *Acacia* sp. over *Triodia* hummock grasslands on sandy plains and floodplains in red-brown sandy clay loam soil.
Bulbostylis burbidgeae	P4 (DBCA)	6.2 km N of study area	Grows in *Triodia* hummock grasslands typically associated with granite boulders, hill tops and outcrops.
Eragrostis crateriformis	P3 (DBCA)	6.1 km E of study area	Grows in low open woodlands over sparse *Acacia* shrublands over *Triodia* grasslands on red sandy clay loam soil associated with drainage lines, floodplains and clay pans.
Gomphrena leptophylla	P3 (DBCA)	8.7 km NW of study area	Grows in hummock grassland, *with Triodia epactia, T. secunda* along drainage lines and floodplains in red sandy loam soils.
Gomphrena pusilla	P2 (DBCA)	9.7 km NW of study area	Grows in open Shrubland of *Acacia bivenosa* over open *Triodia epactia* hummock grassland of over an open tussock of *Cenchrus ciliaris* along limestone ridge tops on brown loam, exposed calcrete rock and calcareous coastal dunes.
Goodenia nuda	P4 (DBCA)	0.6 km SE of study area	Grows in a variety of habitat types including hardpan plains, riparian areas and sandy floodplains in a large variety of vegetation types.
Gymnanthera cunninghamii	P3 (DBCA)	7.2 km NE of study area	Grows in *Eucalyptus*, *Melaleuca* and *Acacia* woodlands over mixed grasslands associated with riverbanks, creeks, drainage lines and floodplains.
Heliotropium muticum	P3 (DBCA)	6.3 km E of study area	Grows in *Acacia* shrubland over hummock grassland in sandy loam plains and floodplains.
Ptilotus mollis	P4 (DBCA)	22.6 km S of study area	Grows on iron outcropping, hill slopes in skeletal red/brown clay loam soils.
Rothia indica subsp. *australis*	P3 (DBCA)	11.5 km SE of study area	Grows in shrublands over *Triodia* hummock grasslands in red sandy to loamy soils
Seringia exastia	T**	13.4 km NE of study area	Grows in a high diversity of habitats.
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3 (DBCA)	13.9 km SW of study area	Grows in *Eucalyptus* and *Acacia* woodlands over *Triodia* hummock grasslands on rocky hills, breakaways and gorges.

Species	Status	Proximity to study area	Habitat
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P! (DBCA)	4.1 km N of study area	Predominantly recorded on coastal dunes but also in red sand plain in *Acacia* shrublands over *Triodia* hummock grasslands.
Triodia chichesterensis	P3 (DBCA)	28.3 km S of study area	Grows in clay-loam soils frequently associated with quartzite on undulating plains and low rises in woodlands and shrublands over *Triodia* hummock grasslands.



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Map author	GW

0 5 10
Kilometers

1 482,000 (at A4) GDA 1994 MGA Zone 50

Study area
Desktop study area (40km buffer)

Status
CR (BC Act)
EN (EPBC Act, BC Act)

P1 (DBCA list)
P2 (DBCA list)
P3 (DBCA list)
P4 (DBCA list)

Figure 5-1

Desktop records of significant flora and vegetation

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5.1.1.3 Introduced flora

The desktop review identified records of 45 introduced species within the desktop search extent, of which three are a Declared Pest one of which is also a WoNS (Table 5-2; Appendix 4).

Table 5-2 Desktop records of significant weeds

Species	Declared Pest	WoNS
**Calotropis procera*	X	
**Opuntia stricta*	X	
**Tamarix aphylla*	X	X

5.1.1.4 Vegetation associations

Regional scale vegetation mapping by Shepherd *et al.* (2002) mapped one vegetation association in the study area (Table 5-3; Figure 5-2). The remaining extent of the vegetation association at the Statewide scale exceeds 99% (DBCA 2018) and is therefore considered of Least Concern (Table 5-3).

Table 5-3 Statewide extent of Pre-European vegetation associations present in the study area (Government of Western Australia 2019)

Vegetation association	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Current extent in DBCA lands (%)	% of study area
589 - Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	728, 768.20	724, 695.82	99.44 %	2.11 %	100%

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0 1 2
Kilometers

1 100,000 (at A4) GDA 1994 MGA Zone 50

Study area

Figure 5-2

Vegetation associations of the study area

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5.1.1.5 Significant vegetation

The DBCA Threatened and Priority Ecological Communities database search identified the presence of one PEC within the desktop search extent (Figure 5-1; Table 5-4). This PEC does not intersect the study area.

Table 5-4 TECs and PECs identified in the desktop review

Community name	Status	Proximity to study area	Description
Eighty Mile System	P3 (DBCA)	38.1 km NE of study area	Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands. Threats: extensive threatening processes acting at landscape scales, namely altered fire regimes, over grazing, erosion, and weed invasion (buffel grass).

5.2 FIELD SURVEY

5.2.1 Flora and vegetation

5.2.1.1 Flora assemblage

A total of 146 flora taxa representing 38 families and 88 genera were recorded in the study area during the field surveys (Appendix 8). Species richness ranged from 3 - 53 species between quadrats (Appendix 2). The assemblage included 140 native species and six introduced species, including 92 perennial species, and 54 annual or short-lived species. The most prominent families recorded were Poaceae (29 species), Fabaceae (20 species), Malvaceae (14 species), Convolvulaceae (13 species) and Cyperaceae (10 species).

5.2.1.2 Significant flora

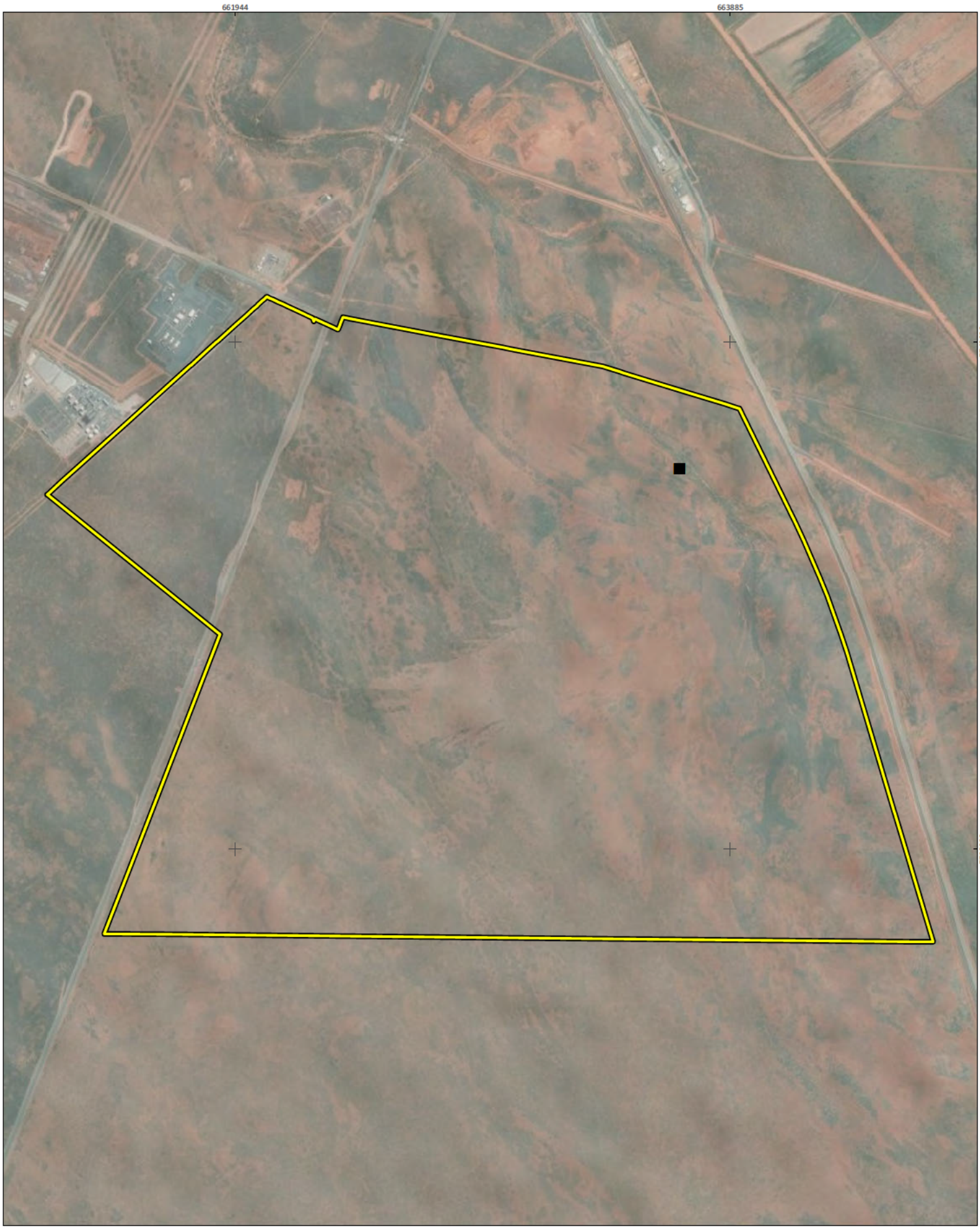
No Threatened flora or Priority flora were recorded during the field survey (Figure 5-3).

A solitary plant of one taxon, *Phyllanthus* sp. Port Hedland Solar Farm was collected during the first field survey. The species occurred in a creek and a thorough foot search of the entire length of the creek within the study area in the second field survey failed to locate any further individuals. The taxon is an unnamed and as such is considered locally significant as a novel species.

The *Phyllanthus* sp. Port Hedland Solar Farm specimen is a tufted perennial herb, up to 50cm high. Stems minutely and sparsely hairy. Stipules brown, triangular 1-2 mm long. Leaves alternately arranged, subsessile, ovate, 4-12 mm long, 2-5 mm wide, upper surface glabrous, margins and lower surface often covered with sparsely arranged minute hairs; lateral veins distinctly raised on the undersurfaces; leaf apices mucronate. Male flowers minute, subsessile. Female flowers pedicellate, floral segments 6, elliptic 0.5-1.0 mm long. Fruits schizocarps, 4 mm across, surfaces sparsely tuberculate. Seeds (mericarps) 2 mm long, brown, surfaces minutely papillate.

Phyllanthus sp. Port Hedland Solar Farm matches some specimens at the WA herbarium from the Pilbara & Kimberley bioregions based on 1. the presence of the minute hairs on the stems & leaf undersurfaces; 2. The raised lateral venation on the undersurfaces of the leaves; 3. Schizocarp surfaces being sparsely tuberculate; 4. Mericarp surfaces being minutely papillate. The specimen also corresponds with *Phyllanthus* sp. B in (Wheeler 1992).

The likelihood of occurrence assessment (section 4.2.2.2) for the remaining significant species identified in the desktop review (section 5.1.1.2) determined eight may possibly occur and six are unlikely to occur (Table 5-6).



Western Australia

PERTH

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Port Hedland Solar Farm Project

Project No	1387
Date	3/12/2021
Drawn by	IN
Map author	GW

0 250 500
Meters

1 19,290 (at A4) GDA 1994 MGA Zone 50

Study area

■ *Phyllanthus* sp. Port Hedland Solar Farm

Figure 5-3

Significant flora records from the field survey

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Table 5-5 Likelihood of occurrence for significant flora identified in the desktop review

Species	Status	Likelihood of occurrence
Abutilon sp. *Pritzelianum* (S. van Leeuwen 5095)	P3 (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Bulbostylis burbidgeae	P4 (DBCA)	Unlikely, lack of suitable habitat in study area.
Eragrostis crateriformis	P3 (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Gomphrena leptophylla	P3 (DBCA)	Possible, suitable habitat in study area that was satisfactorily searched, however the annual species may not have been present/detectable at the time of the surveys.
Gomphrena pusilla	P2 (DBCA)	Unlikely, lack of suitable habitat in study area.
Goodenia nuda	P4 (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Gymnanthera cunninghamii	P3 (DBCA)	Unlikely, suitable habitat in study area but was satisfactorily searched.
Heliotropium muticum	P3 (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Ptilotus mollis	P4 (DBCA)	Unlikely, lack of suitable habitat in study area.
Rothia indica subsp. *australis*	P3 (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Seringia exastia	T**	Possible, suitable habitat in study area not all of which was searched.
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P! (DBCA)	Possible, suitable habitat in study area not all of which was searched.
Triodia chichesterensis	P3 (DBCA)	Unlikely, lack of suitable habitat in study area.

5.2.1.3 Introduced flora

Six introduced flora species were recorded during the survey, none are a Declared Pest or WoNS (Table 5-7).

Table 5-6 Introduced flora recorded in the field survey

Family	Species	Declared Pest	WoNS
Amaranthaceae	**Aerva javanica*	N	N
Fabaceae	**Stylosanthes hamata*	N	N
Poaceae	**Echinochloa colona*	N	N
Poaceae	**Cenchrus ciliaris*	N	N
Poaceae	**Chloris virgata*	N	N
Poaceae	**Cynodon dactylon*	N	N

5.2.1.4 Vegetation types

Six vegetation types were defined for the study area based on the cluster analysis (Figure 5-4). They comprised *Acacia* shrublands over *Triodia* hummock grasslands, *Triodia* hummock grasslands, isolated *Eucalyptus victrix* trees over *Acacia* dominated shrublands over mixed species grassland on creek banks and a low sparse grassland with mixed low forbs on small claypans (Table 5-9; Figure 5-5). *Acacia* shrublands over *Triodia* hummock grasslands (vegetation types AtpAsTe and AtpAsTe) and *Triodia* hummock grasslands (vegetation types AsTe and Te) combined covered 97.6% of the study area (Table 5-9). The isolated *Eucalyptus victrix* trees over *Acacia* dominated shrublands over mixed species grassland (vegetation type EvAaAsTe) was riparian vegetation of a creek system and comprised just 1% of the study area. Vegetation type EsPm was restricted to small claypans and comprised just 0.1% of the study area. A small proportion (1.2%) of the study area was tracks completely cleared of vegetation.

5.2.1.5 Vegetation condition

Remnant vegetation in the study area was recorded to be in Degraded to Excellent condition (Figure 5-6) with the majority (98.6%) in Excellent to Very Good condition (Table 5-13). Areas in Excellent condition showed no evidence of disturbance. Areas in Very Good condition showed evidence of historic clearing and/or low level weed infestation. Degraded areas were primarily overgrown vehicle tracks and road edges. Cleared areas were recorded as Completely Degraded (devoid of vegetation).

5.2.1.6 Significant vegetation

None of the vegetation was considered representative of a TEC or PEC.

Vegetation type EvAaAsTe was habitat for the locally significant flora *Phyllanthus* aff *erwinii* and comprise just 1% of the study area and subsequently may be considered locally significant as a role as a refuge for significant flora and due to restricted distribution. Vegetation type EsPm comprised only 0.1% of the study area and may be considered locally significant due to restricted distribution.

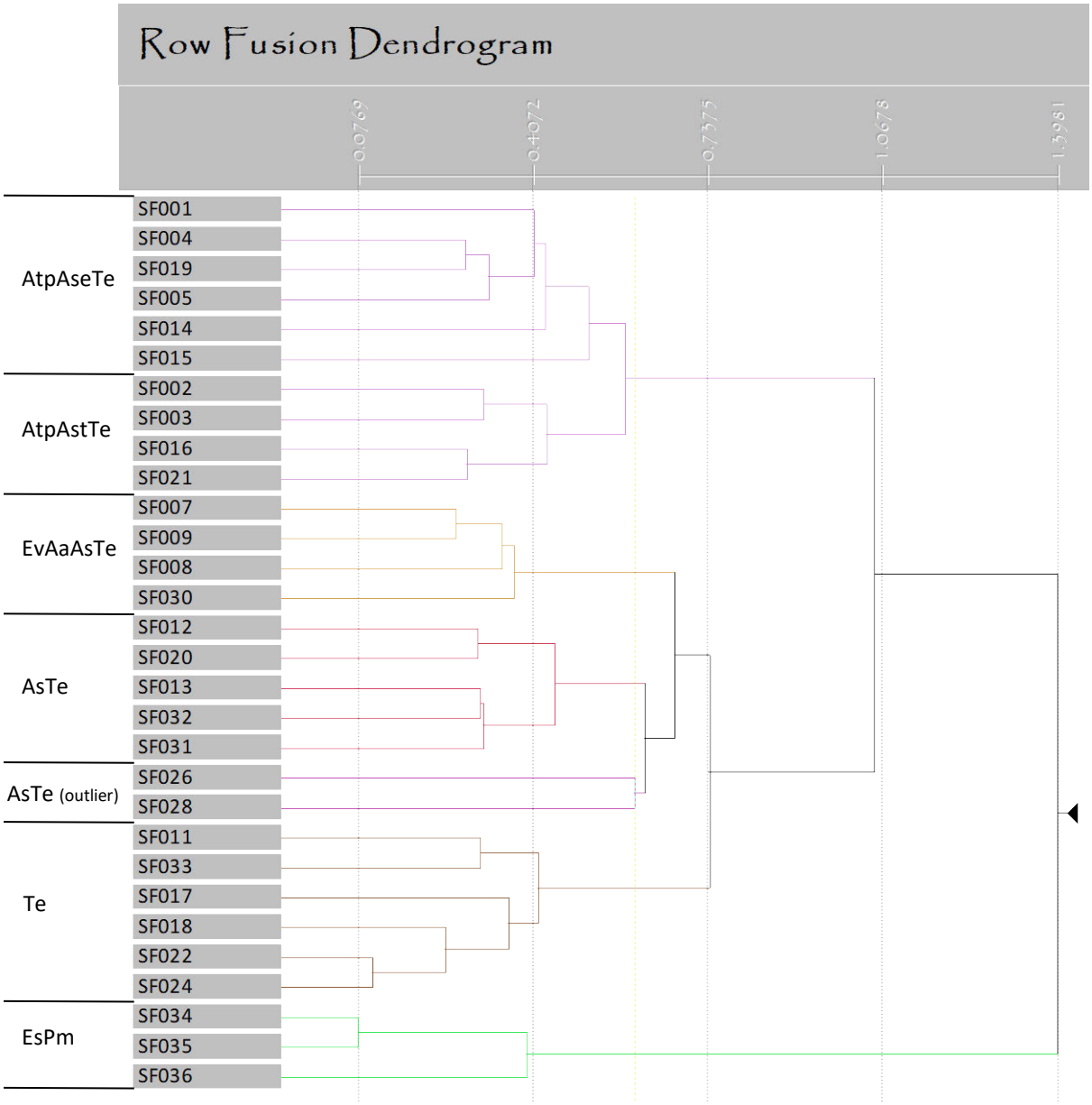
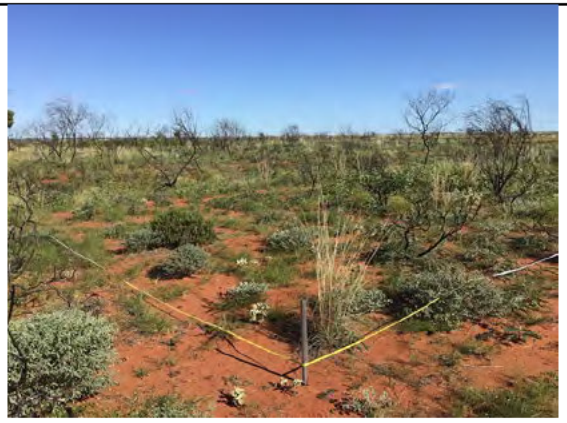


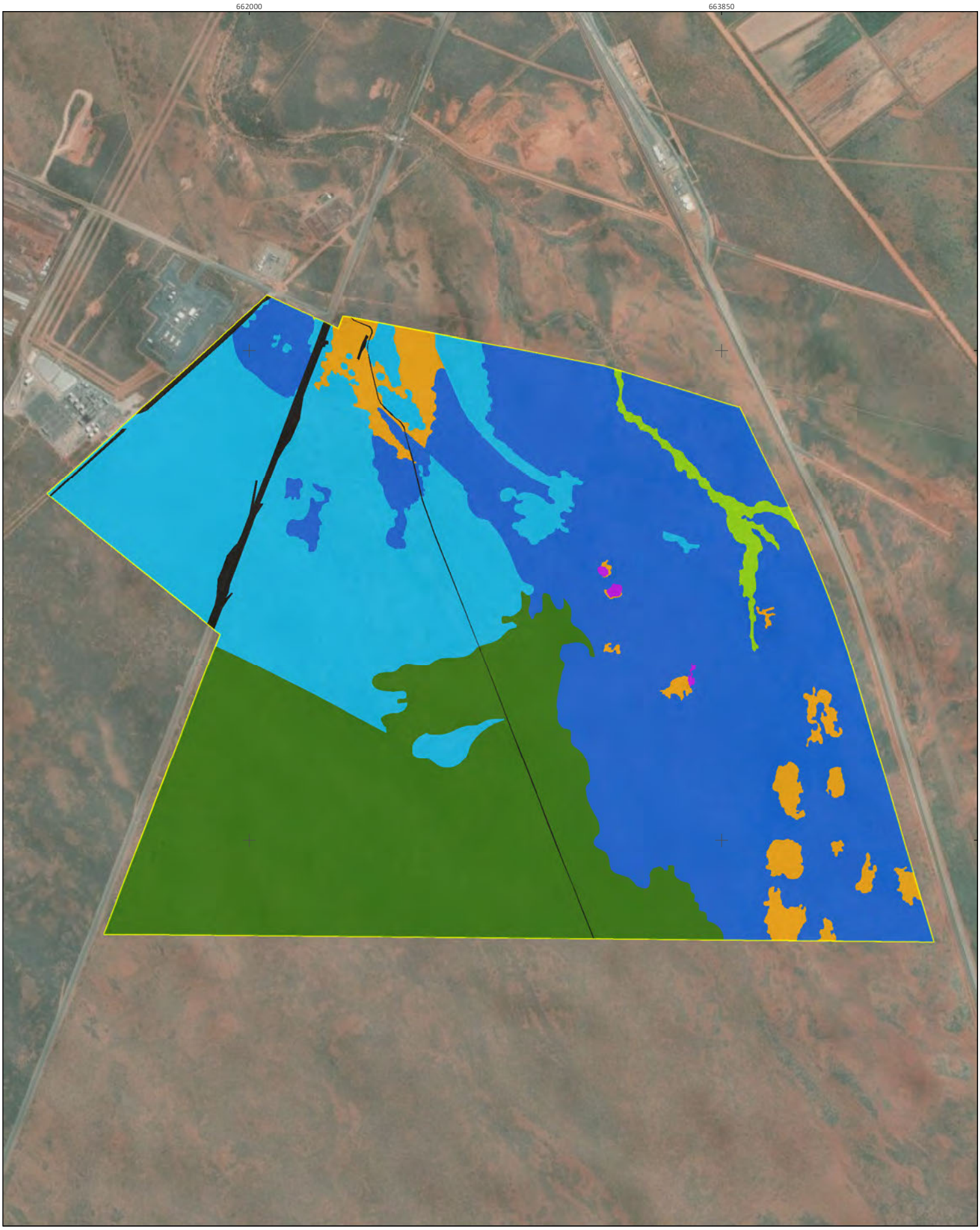
Figure 5-4 Hierarchical clustering (UPGMA) of the flora quadrats of the study area

Table 5-7 Vegetation types, description and extent in the study area

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
AtpAsTe	SF001, SF004, SF005, SF0014, SF0015, SF019	Open mid shrubland of *Acacia tumida* var. *pilbarensis* and *A. sericophylla* over a low shrubland of *Acacia stellaticeps*, *Corchorus incanus* subsp. *incanus* and *Bonamia erecta*, over mid to low grassland of *Triodia epactia*, *Chrysopogon fallax* and *Triodia schinzii*	157 ha, 25.1%	
AtpAsTe	SF002, SF003, SF016, SF021	Mid sparse shrubland of *Acacia tumida* var. *pilbarensis* over low isolated shrubs of *Acacia stellaticeps*, *Senna notabilis* and *Bonamia erecta*, over mid to low open grassland of *Triodia epactia*, *Chrysopogon fallax* and *Aristida holathera*	186.9 ha, 29.9%	

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
EvAaAsTe	SF007, SF008, SF009, SF030	Low isolated trees of *Eucalyptus victrix* over isolated tall shrubs of *Acacia ampliceps* and variably present *A. colei* over low isolated shrubs of *Acacia stellaticeps*, *Sesbania cannabina* and *Pluchea ferdinandi-muelleri* over a mid to low grassland of *Triodia epactia*, **Cenchrus ciliaris* and *Chrysopogon fallax*	6.3 ha, 1%	
AsTe	SF012, SF013, SF020, SF031, SF032, SF026, SF028	Mid isolated shrubs of *Acacia stellaticeps* over a mixed grassland of *Triodia epactia*, *Eriachne obtusa* and *Fimbristylis dichotoma*.	243.9 ha, 39%	

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
Te	SF011, SF017, SF018, SF022, SF024, SF033	Low grassland of *Triodia epactia*, *Triodia secunda* and *Eriachne obtusa*.	22.6 ha, 3.6%	
EsPm	SF034, SF035, SF036	Low sparse tussock grassland of *Eriachne sulcata*, occasionally with *E. obtusa*, over low mixed herbs including *Peplidium muelleri*, *Marsilea hirsuta* and *Byblis liniflora*	0.5 ha, 0.1%	



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0 250 500
Meters

1 19,300 (at A4) GDA 1994 MGA Zone 50

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Study area
EsPm
Vegetation type
EvAaAsTe
AsTe
Te
AtpAseTe
Cleared
AtpAstTe

Figure 5-5

Vegetation types recorded in the field survey

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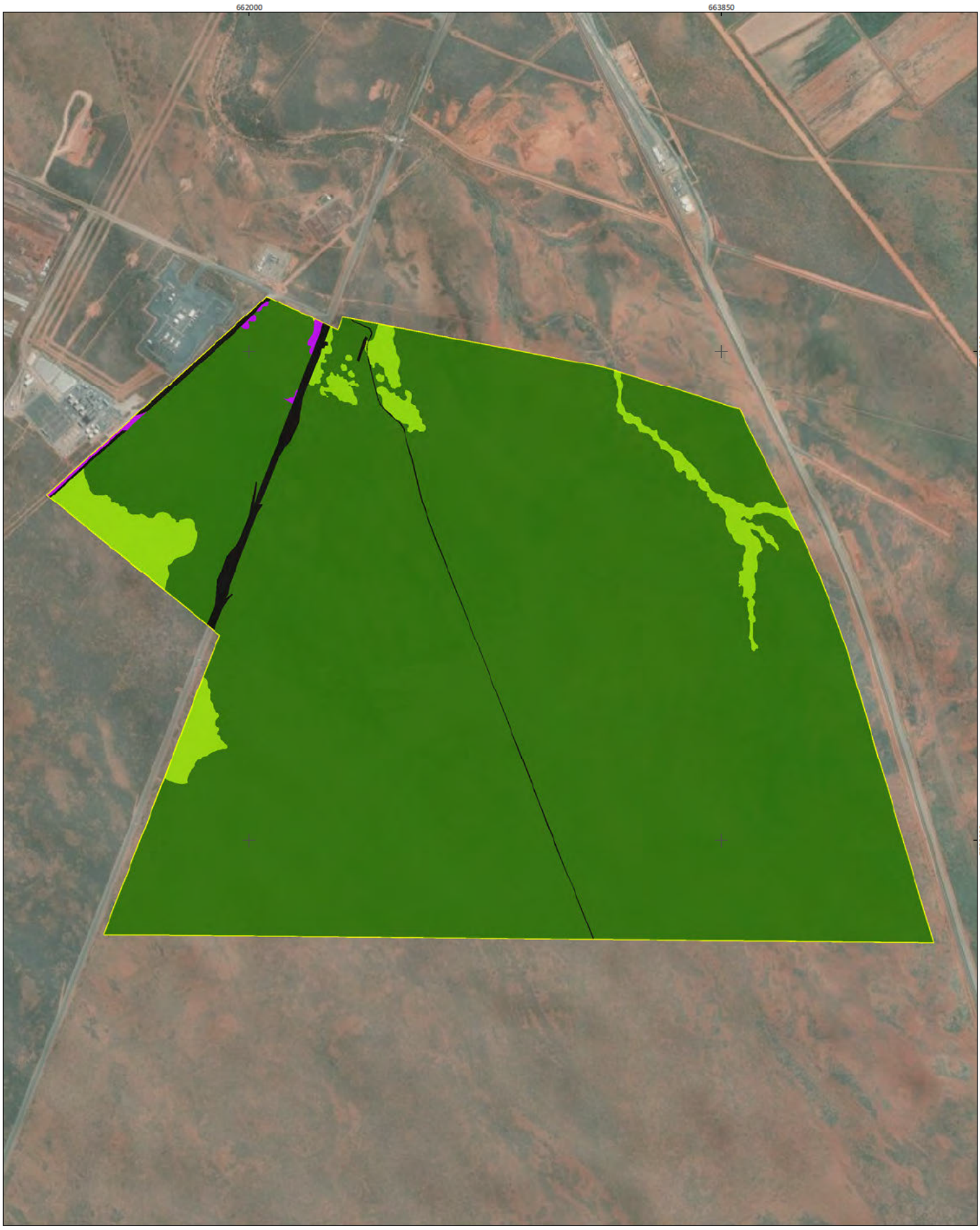
Table 5-8 Vegetation condition – extent of each condition rating in study area

Condition rating	Area (ha)	% of study area
Excellent	590.5	94.5
Very Good	25.9	4.1
Degraded	1.1	0.2
Completely Degraded	7.3	1.2



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0 250 500
Meters

1 19,300 (at A4) GDA 1994 MGA Zone 50

Study area

Vegetation condition

- Excellent
- Very Good
- Degraded
- Cleared

Figure 5-6

Vegetation condition in the study area

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5.3 SURVEY LIMITATIONS

The limitations of the flora and vegetation survey and terrestrial fauna survey have been considered in accordance with EPA (2016b, c) (Table 5-21).

Table 5-9 Consideration of potential survey limitations

Limitations	Comments
Availability of contextual information at a regional and local scale	The ENV (2011) survey provided substantial regional information and collated flora data from numerous local surveys. Available local reports were limited in number.
Competency/experience of the team carrying out the survey	Dr Grant Wells who lead all field surveys has in excess of 15 years experience conducting surveys in the Pilbara bioregion. Dr Grace Wells who undertook mapping also has in excess of 15 years experience conducting vegetation surveys and mapping in the Pilbara bioregion.
Scope and completeness	All items in the scope were achieved.
Proportion of flora and fauna recorded and/or collected, any identification issues	Due to good seasonal conditions promoting flowering and fruiting and targeted searches in the second season survey for plants not identified to species level after the first field survey all species in the quadrats were identified to species level. The near flattening of the species accumulation curve (Figure 5-7) indicates that sufficient sites were surveyed to capture the flora of the study present during the time of the surveys.
Access within the study area	An access track ran central through the study area and subsequently all areas within the study area were accessible by either car or on foot.
Timing, rainfall, season	Surveys were conducted during the Primary and Supplementary survey periods appropriate for the botanical province (EPA 2016b). The survey in the Primary survey period was conducted following above average summer rainfall.
Disturbance that may have affected the results of the survey	The study area was a patchwork of fire scars with the most recent occurring less than two years before the survey that affected ca. 48% of the area. This area contained a high number of fire ephemeral species and subsequently the vegetation is likely to change as it matures.

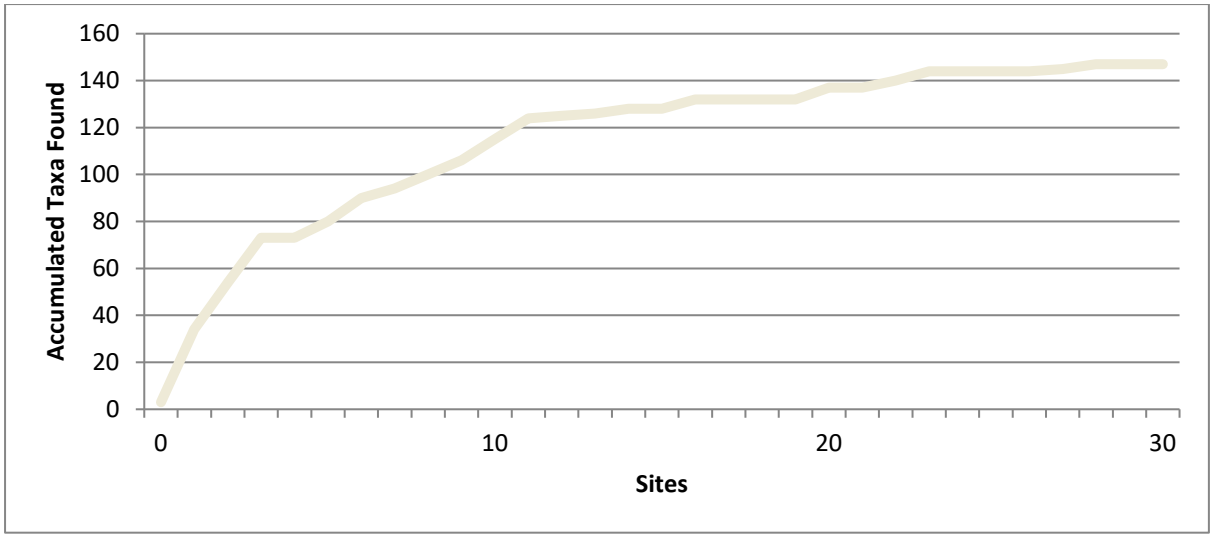

Figure 5-7 Species accumulation curve for flora sites surveyed

6 DISCUSSION

6.1 FLORA AND VEGETATION

The current survey recorded just under one third (30.8%) of the species identified in the desktop assessment from an area representing 0.13% of the desktop assessment 40 km radius survey extent. The number of species recorded in the current survey (146 in ca.670 ha) also compares favourably with the number recorded in the ENV (2011) regional survey (388 in 80 874 ha). The Poaceae, Fabaceae, Malvaceae and Cyperaceae were dominant families for the desktop assessment and the field survey and these families were also prominent in the previous regional survey (ENV 2011).

6.1.1 Significant flora

Phyllanthus sp. Port Hedland Solar Farm closely resembles *Phyllanthus* sp. B Kimberley Flora that is known from two records (WA Herbarium 1998-) each associated with riparian vegetation. *Phyllanthus* sp. Port Hedland Solar Farm also resembles three unnamed *Phyllanthus* specimens housed at the Western Australian Herbarium. Review of the records of these specimens (WA Herbarium 1998-) determined two occur in the Pilbara bioregion and one in the Great Sandy Desert. All of the records were again associated with riparian vegetation. The closest record to the current study area occurred approximately 70 km to the east.

No population sizes are provided for any of the WA Herbarium (1998-) records and subsequently it is not possible to determine what proportion of the potential population of the *Phyllanthus* sp. was represented by the single plant recorded in the current survey. This population appears to represent only the sixth population for the taxon in Western Australia and the third for the Pilbara bioregion.

The Threatened species *Seringia exastia* was recorded as possibly within the study area. *Seringia exastia* (CR) is due to have its conservation status removed after a recent taxonomic study assessed genomic and morphological characters in several S*eringia* taxa and discovered that *S. exastia* is synonymous with *S. elliptica* (Binks *et al.* 2020). Given that *S. elliptica* is common and widespread throughout the Pilbara and beyond, following taxonomic revision, *S. exastia* will be considered common and widespread too. Results from database searches undertaken by Phoenix (DBCA 2020) note that a nomination to delist *S. exastia* has been prepared and considered by the WA Threatened Species Scientific Committee (TSSC). It is anticipated that at the next TSSC meeting recommendations will be made to the Minister to delist. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required.

Of the remaining seven Priority flora identified to potentially occur in the study area, six (*Abutilon* sp. *Pritzelianum* (S. van Leeuwen 5095), *Eragrostis crateriformis, Goodenia nuda*, *Heliotropium muticum, Rothia indica* subsp. *australis* and *Tephrosia rosea* var. Port Hedland (A.S. George 1114)) have 21 or more records (WA Herbarium 1998-) and/or occur across several bioregions and subregions and/or have large populations records. Subsequently any records of the species within the study area are unlikely to represent a substantial proportion of the total population for the species.

The remaining species, *Gomphrena leptophylla* (P3), has been recorded in four bioregions but is only known from eight records with population sizes recorded ranging from one to ten plants only. Subsequently, any plants within the study area may represent a reasonable proportion of the total population of the species.

6.1.2 Introduced flora

None of the weed species recorded are a Declared Pest of WoNS. Weed species were largely restricted to the creek system and road verges that occur in the study area.

All of the introduced flora recorded during the field have previously been recorded in the Pilbara bioregion (WA Herbarium 1998-) and all have an extensive range in Western Australia recorded in numerous bioregions.

6.1.3 Vegetation

The majority of vegetation types of the current survey align with the vegetation association of Shepherd *et al.* (2002), 589 - Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex. Subsequently, the majority of the vegetation in the current survey aligns a vegetation association with a high proportion of pre-European extent remaining that is classed as Least Concern.

The vegetation defined for the study area does not represent any listed TEC or PEC.

Vegetation type EsPm from the current survey was considered locally significant due to restricted distribution in the study area. The community was restricted to small claypans but was comprised of common species with a wide distribution in the Pilbara bioregion that were also recorded in other vegetation types within the current study area. As the vegetation type occupied only a small proportion of the study area it may possibly be avoided during development.

Vegetation type EvAaAsTe from the current survey was considered locally significant due to restricted distribution in the study area and as a role as refuge for the significant flora *Phyllanthus* sp. Port Hedland Solar Farm. This vegetation was the riparian vegetation of the only creek system in the study area and as it occupied only a small proportion of the study area it may possibly be avoided during development.

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Appendix 1 Survey site locations

Site	Sample type	Latitude	Longitude
SF001	Quadrat	-20.4361	118.54951
SF002	Quadrat	-20.44311	118.55171
SF003	Quadrat	-20.44738	118.55028
SF004	Relevé	-20.43476	118.55156
SF005	Quadrat	-20.43113	118.5502
SF007	Quadrat	-20.43164	118.56697
SF008	Quadrat	-20.43333	118.56898
SF009	Quadrat	-20.43462	118.57199
SF011	Quadrat	-20.43036	118.55751
SF012	Quadrat	-20.44091	118.5707
SF013	Quadrat	-20.42886	118.55349
SF014	Relevé	-20.42921	118.55418
SF015	Quadrat	-20.43127	118.5581
SF016	Quadrat	-20.4463	118.56468
SF017	Quadrat	-20.44828	118.57261
SF018	Quadrat	-20.44495	118.57313
SF019	Quadrat	-20.4377	118.55451
SF020	Quadrat	-20.43418	118.55824
SF021	Quadrat	-20.43977	118.56333
SF022	Quadrat	-20.43687	118.5663
SF024	Relevé	-20.44096	118.56939
SF026	Relevé	-20.44718	118.5716
SF028	Quadrat	-20.4421	118.56581
SF030	Relevé	-20.43581	118.57151
SF031	Relevé	-20.43084	118.56943
SF032	Relevé	-20.42957	118.56368
SF033	Relevé	-20.42875	118.55953
SF034	Relevé	-20.43695	118.56618
SF035	Relevé	-20.44091	118.56942
SF036	Relevé	-20.43763	118.56661

Appendix 2 Flora survey site descriptions

Site details			
Site	**SF001**	**Position (WGS84)**	-20.4361, 118.549507
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Tall open *Acacia inaequilatera*, *A. sericophylla* and *A. tumida* var *pilbarensis* shrubland over low open *Acacia stellaticeps*, *Bonamia linearis* and *Corchorus incanus* subsp. *incanus* shrubland over mid *Triodia epactia, T. schinzii* and *Chrysopogon fallax* grassland.		
Habitat	shrubland		
Disturbance	Weed infestation		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	60	**Tree cover (%)**	10
Shrub cover (%)	15	**Grass cover (%**	50
Herb cover (%)	5		

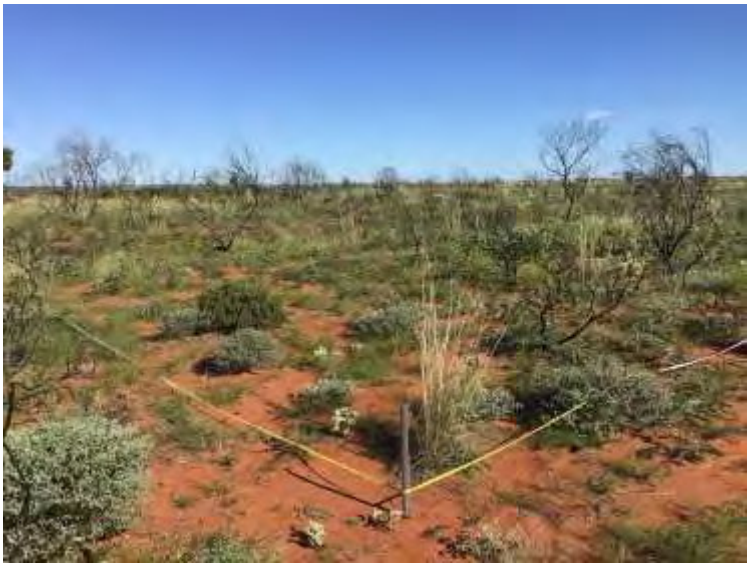
Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (40)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		40	0.6		
Acacia stellaticeps		10	0.7		
Triodia schinzii		8	1		
Acacia sericophylla		4	3		
Acacia tumida var. *pilbarensis*		4	2.5		
Corchorus incanus subsp. *incanus*		4	0.4		
Bonamia linearis		4	0.3		
Acacia inaequilatera		2	2.5		
Chrysopogon fallax		1	0.7		
Cassytha capillaris		1	0.4		
Dolichandrone occidentalis		0.2	1.5		
Hibiscus sturtii var. *campylochlamys*		0.2	0.4		
Trianthema pilosum		0.2	0.1		
Cucumis variabilis		0.1	1.2		
Hibiscus brachychlaenus		0.1	1		
**Cenchrus ciliaris*	Weed	0.1	0.5		
Eriachne helmsii		0.1	0.5		
Distimake davenportii		0.1	0.5		
Waltheria indica		0.1	0.5		
Ptilotus polystachyus		0.1	0.5		
Eragrostis eriopoda		0.1	0.4		
Cleome viscosa		0.1	0.4		
Aristida hygrometrica		0.1	0.4		
Ptilotus astrolasius		0.1	0.4		
Ptilotus calostachyus		0.1	0.4		
Sida rohlenae subsp. *rohlenae*		0.1	0.4		
Solanum lasiophyllum		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Indigofera monophylla		0.1	0.4		
Fimbristylis neilsonii		0.1	0.3		
Evolvulus alsinoides var. *decumbens*		0.1	0.25		
Euphorbia biconvexa		0.1	0.2		
Tephrosia densa		0.1	0.2		
Indigofera linifolia		0.1	0.15		
Mollugo molluginea		0.1	0.15		
Urochloa holosericea subsp. *velutina*		0.1	0.15		
Heliotropium foliatum		0.1	0.15		
Boerhavia coccinea		0.1	0.1		
Tribulopis angustifolia		0.1	0.1		

Yakirra australiensis var. *australiensis*	0.1	0.1

Site details			
Site	**SF002**	**Position (WGS84)**	-20.443109, 118.55171
Slope	gentle	**Topography**	undulating plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Emergent mid to tall open *Acacia tumida* var *pilbarensis*, *A. colei* var. *colei* and *A. inaequilatera* shrubland over low open *Acacia stellaticeps*, *Bonamia erecta* and *Indigofera monophylla* shrubland over low open *Triodia epactia, Aristida hygrometrica* and *Chrysopogon fallax* grassland.		
Habitat	shrubland		
Disturbance	Historic clearing, Weed infestation		
Vegetation condition	Very Good	**Fire age**	recent (<1 year)
Total veg. cover (%)	40	**Tree cover (%)**	0.2
Shrub cover (%)	25	**Grass cover (%**	15
Herb cover (%)	1		



Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (51)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		10	0.2		
Triodia epactia		10	0.2		
Indigofera monophylla		5	0.4		
Bonamia erecta		5	0.3		
Aristida hygrometrica		4	0.4		
Acacia tumida var. *pilbarensis*		3	0.5		
Senna notabilis		2	0.25		
Chrysopogon fallax		1	0.6		
Corchorus incanus subsp. *incanus*		1	0.4		
Triodia schinzii		0.5	0.4		
Bonamia alatisemina		0.5	0.15		
Tribulopis angustifolia		0.3	0.1		
Owenia reticulata		0.2	4		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.2	0.5		
Yakirra australiensis var. *australiensis*		0.2	0.15		
Acacia inaequilatera		0.1	2.2		
Carissa lanceolata		0.1	1.5		
Acacia sericophylla		0.1	1		
Streptoglossa decurrens		0.1	0.7		
Aristida inaequiglumis		0.1	0.6		
Cucumis variabilis		0.1	0.5		
Hakea lorea subsp. *lorea*		0.1	0.5		
Ptilotus polystachyus		0.1	0.5		
**Cenchrus ciliaris*	Weed	0.1	0.5		
Sida rohlenae subsp. *rohlenae*		0.1	0.5		
Fimbristylis neilsonii		0.1	0.5		
**Aerva javanica*	Weed	0.1	0.5		
Seringia nephrosperma		0.1	0.4		
Acacia ampliceps		0.1	0.4		
Gossypium australe		0.1	0.4		
Goodenia microptera		0.1	0.4		
Cleome viscosa		0.1	0.4		
Eragrostis eriopoda		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.3		
Paraneurachne muelleri		0.1	0.3		
Waltheria indica		0.1	0.3		
Sida sp. Pindan (B.G. Thomson 3398)		0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Hibiscus leptocladus		0.1	0.3		

Ptilotus astrolasius	0.1	0.3		
Digitaria brownii	0.1	0.3		
Operculina aequisepala	0.1	0.3		
Hibiscus sturtii var. *campylochlamys*	0.1	0.3		
Eriachne obtusa	0.1	0.3		
Cleome uncifera	0.1	0.25		
Mollugo molluginea	0.1	0.2		
Tribulus hirsutus	0.1	0.2		
Polymeria calycina	0.1	0.2		
Trianthema pilosum	0.1	0.15		
Bonamia linearis	0.1	0.01		
Acacia colei var. *colei*			3	0.5

Site details			
Site	**SF003**	**Position (WGS84)**	-20.44738, 118.550283
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Emergent mid to tall open *Acacia tumida* var *pilbarensis* shrubland over low open *Acacia stellaticeps*, *Bonamia erecta* and *Indigofera monophylla* shrubland over low open *Aristida holathera*, *Chrysopogon fallax* and *Triodia* spp. grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	recent (<1 year)
Total veg. cover (%)	25	**Tree cover (%)**	0
Shrub cover (%)	20	**Grass cover (%**	6
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (39)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Bonamia erecta		7	0.4		
Acacia tumida var. *pilbarensis*		3	0.4		
Aristida holathera		3	0.3		
Acacia stellaticeps		3	0.2		
Indigofera monophylla		2	0.4		
Triodia lanigera		2	0.3		
Chrysopogon fallax		1	0.5		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		1	0.4		
Senna notabilis		1	0.3		
Triodia epactia		1	0.2		
Bonamia linearis		0.5	0.15		
Yakirra australiensis var. *australiensis*		0.5	0.15		
Hibiscus leptocladus		0.2	0.4		
Tribulopis angustifolia		0.2	0.1		
Owenia reticulata		0.1	2.5		
Cucumis variabilis		0.1	1.2		
Aristida inaequiglumis		0.1	1.2		
Ptilotus polystachyus		0.1	0.5		
Triumfetta chaetocarpa		0.1	0.4		
Triodia schinzii		0.1	0.4		
Corchorus incanus subsp. *incanus*		0.1	0.4		
Goodenia microptera		0.1	0.4		
Eragrostis eriopoda		0.1	0.4		
Eriachne obtusa		0.1	0.4		
Ptilotus astrolasius		0.1	0.4		
Paraneurachne muelleri		0.1	0.4		
Digitaria brownii		0.1	0.4		
Ptilotus fusiformis		0.1	0.3		
Corchorus elachocarpus		0.1	0.3		
Solanum lasiophyllum		0.1	0.3		
Cassytha capillaris		0.1	0.3		
Leptosema anomalum		0.1	0.3		
Afrohybanthus aurantiacus		0.1	0.3		
Polymeria calycina		0.1	0.25		
Euphorbia biconvexa		0.1	0.2		
Goodenia lamprosperma		0.1	0.2		
Trianthema pilosum		0.1	0.15		
Mollugo molluginea		0.1	0.15		
Euphorbia vaccaria var. *vaccaria*		0.1	0.1		

Site details			
Site	**SF004**	**Position (WGS84)**	-20.434763, 118.551557
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated tall *Acacia tumida* var *pilbarensis* and *A. sericophylla* shrubs over low *Acacia stellaticeps*, *Bonamia erecta* and *Corchorus incanus* subsp. *incanus* shrubland over mid *Triodia epactia, T. schinzii* and *Paraneurachne muelleri* grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	65	**Tree cover (%)**	1
Shrub cover (%)	30	**Grass cover (%**	50
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	25-Mar-2021	unbounded	Grant Wells
Relevé	2	15-Sep-2021	unbounded	Grant Wells

Species (31)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		35	0.6		
Acacia stellaticeps		25	1		
Corchorus incanus subsp. *incanus*		5	0.8		
Triodia schinzii		5	0.6		
Paraneurachne muelleri		5	0.5		
Acacia tumida var. *pilbarensis*		0.5	3		
Acacia sericophylla		0.5	2.5		
Cassytha capillaris		0.5	0.3		
Chrysopogon fallax		0.2	0.5		
Bonamia erecta		0.2	0.3		
Cucumis variabilis		0.1	1.2		
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		0.1	0.5		
Waltheria indica		0.1	0.5		
Triumfetta chaetocarpa		0.1	0.45		
Ptilotus polystachyus		0.1	0.4		
Hibiscus sturtii var. *campylochlamys*		0.1	0.4		
Senna notabilis		0.1	0.4		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.4		
Ptilotus astrolasius		0.1	0.4		
Aristida hygrometrica		0.1	0.4		
Sida sp. Pindan (B.G. Thomson 3398)		0.1	0.4		
Indigofera monophylla		0.1	0.4		
Eragrostis eriopoda		0.1	0.3		
Eriachne obtusa		0.1	0.3		
Evolvulus alsinoides var. *decumbens*		0.1	0.3		
Urochloa holosericea subsp. *velutina*		0.1	0.3		
Yakirra australiensis var. *australiensis*		0.1	0.1		
Mollugo molluginea		0.1	0.1		
Bonamia pilbarensis		0.1	0.05		
Bonamia linearis		0.1	0.05		
Hibiscus leptocladus				0.1	0.4

Site details			
Site	**SF005**	**Position (WGS84)**	-20.431133, 118.550204
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated tall *Acacia tumida* var. *pilbarensis*, *A. sericophylla* and *Owenia reticulata* shrubs over low *Acacia stellaticeps*, *Bonamia erecta* and *Senna notabilis* shrubland over low *Triodia epactia*, *Aristida hygrometrica* and *Paraneurachne muelleri* grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	65	**Tree cover (%)**	1
Shrub cover (%)	35	**Grass cover (%**	35
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (35)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		25	1		
Triodia epactia		25	0.4		
Bonamia erecta		8	0.4		
Aristida hygrometrica		7	0.4		
Acacia tumida var. *pilbarensis*		1	2.5		
Senna notabilis		1	0.4		
Paraneurachne muelleri		1	0.4		
Indigofera monophylla		0.5	0.4		
Bonamia linearis		0.5	0.2		
Corchorus incanus subsp. *incanus*		0.2	0.5		
Cassytha capillaris		0.2	0.4		
Bonamia alatisemina		0.2	0.15		
Owenia reticulata		0.1	3.5		
Acacia sericophylla		0.1	2		
Hibiscus brachychlaenus		0.1	1.5		
Hakea lorea subsp. *lorea*		0.1	1.3		
Chrysopogon fallax		0.1	0.6		
Aristida inaequiglumis		0.1	0.6		
Triodia schinzii		0.1	0.5		
Triumfetta chaetocarpa		0.1	0.5		
Eriachne obtusa		0.1	0.4		
Hibiscus leptocladus		0.1	0.4		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.4		
Sida sp. Pindan (B.G. Thomson 3398)		0.1	0.4		
Urochloa holosericea subsp. *velutina*		0.1	0.4		
Eriachne aristidea		0.1	0.3		
Eragrostis eriopoda		0.1	0.3		
Dodonaea coriacea		0.1	0.3		
Solanum diversiflorum		0.1	0.3		
Afrohybanthus aurantiacus		0.1	0.3		
Evolvulus alsinoides var. *decumbens*		0.1	0.25		
Tephrosia densa		0.1	0.2		
Euphorbia biconvexa		0.1	0.2		
Solanum cleistogamum		0.1	0.15		
Yakirra australiensis var. *australiensis*		0.1	0.1		

Site details			
Site	**SF007**	**Position (WGS84)**	-20.431636, 118.56697
Slope	gentle	**Topography**	creek
Soil colour	red-orange	**Soil texture**	sand, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (23 Mar 2021)			
Sample description	Low open *Eucalyptus victrix* woodland over tall open *Acacia ampliceps*, *A. trachycarpa* and *A. colei* var. *colei* shrubland over low *Triodia epactia*, *Eulalia aurea* and **Cynodon dactylon* grassland.		
Habitat	open woodland		
Disturbance	Weed infestation		
Vegetation condition	Very Good	**Fire age**	
Total veg. cover (%)	70	**Tree cover (%)**	10
Shrub cover (%)	3	**Grass cover (%**	60
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	23-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (45)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		60	0.5		
Eucalyptus victrix		7	5		
Eulalia aurea		5	0.6		
Acacia ampliceps		3	2.5		
Acacia colei var. *colei*		2	2.2		
**Cynodon dactylon*	Weed	2	0.3		
Acacia trachycarpa		1	2		
Sesbania cannabina		1	0.8		
Chrysopogon fallax		1	0.6		
Ipomoea muelleri		1	0.4		
Cassytha capillaris		1	0.4		
Acacia stellaticeps		1	0.4		
Pluchea ferdinandi-muelleri		0.5	0.5		
Carissa lanceolata		0.2	1.8		
Adriana tomentosa var. *tomentosa*		0.2	1.2		
Triodia secunda		0.2	0.25		
Corymbia candida subsp. *lautifolia*		0.1	1.5		
Cyperus conicus		0.1	1		
Cucumis variabilis		0.1	0.5		
Phyllanthus maderaspatensis		0.1	0.5		
Corchorus incanus subsp. *incanus*		0.1	0.5		
Goodenia lamprosperma		0.1	0.5		
**Cenchrus ciliaris*	Weed	0.1	0.5		
Cleome viscosa		0.1	0.4		
Eriachne obtusa		0.1	0.4		
Aristida holathera		0.1	0.4		
Pluchea rubelliflora		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Euphorbia biconvexa		0.1	0.3		
Eragrostis eriopoda		0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Abildgaardia oxystachya		0.1	0.2		
**Stylosanthes hamata*	Weed	0.1	0.2		
Ipomoea coptica		0.1	0.2		
Iseilema membranaceum		0.1	0.2		
Murdannia graminea		0.1	0.2		
Polymeria ambigua		0.1	0.2		
Eriachne aristidea		0.1	0.2		
Dactyloctenium radulans		0.1	0.15		

Grona filiformis	0.1	0.15
Paspalidium rarum	0.1	0.15
Calandrinia tepperiana	0.1	0.1
Byblis liniflora	0.1	0.1
Neptunia dimorphantha	0.1	0.1
Mollugo molluginea	0.1	0.08

Site details			
Site	**SF008**	**Position (WGS84)**	-20.433333, 118.568982
Slope	moderate	**Topography**	creek
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (26 Mar 2021)			
Sample description	Low open *Eucalyptus victrix* woodland over tall open *Acacia ampliceps*, *A. tumida* var. pilbarensis and *A. trachycarpa* shrubland over mid *Triodia epactia* and **Cenchrus ciliaris* grassland.		
Habitat	open woodland		
Disturbance	Livestock tracks, Weed infestation		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	60	**Tree cover (%)**	15
Shrub cover (%)	10	**Grass cover (%**	50
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	26-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (45)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		40	0.6		
Acacia ampliceps		11	3.5		
**Cenchrus ciliaris*	Weed	10	0.6		
Eucalyptus victrix		8	5		
Sesbania cannabina		3	0.7		
Acacia trachycarpa		2	2.5		
Acacia tumida var. *pilbarensis*		1	3		
Cassytha capillaris		1	0.5		
Cucumis variabilis		0.1	1.5		
Carissa lanceolata		0.1	1.2		
Cyperus conicus		0.1	1.2		
Crotalaria cunninghamii		0.1	1.2		
Ipomoea muelleri		0.1	1		
Aristida holathera		0.1	0.6		
Chrysopogon fallax		0.1	0.6		
Pluchea ferdinandi-muelleri		0.1	0.5		
Rhynchosia minima		0.1	0.5		
Waltheria indica		0.1	0.5		
Cleome viscosa		0.1	0.45		
Corchorus incanus subsp. *incanus*		0.1	0.4		
Fimbristylis rara		0.1	0.4		
**Chloris virgata*	Weed	0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.3		
Stemodia grossa		0.1	0.3		
Goodenia lamprosperma		0.1	0.3		
**Stylosanthes hamata*	Weed	0.1	0.3		
Euphorbia biconvexa		0.1	0.25		
Pluchea rubelliflora		0.1	0.25		
Senna notabilis		0.1	0.25		
Alternanthera angustifolia		0.1	0.2		
Ipomoea coptica		0.1	0.2		
Solanum diversiflorum		0.1	0.2		
Fimbristylis dichotoma		0.1	0.2		
Dactyloctenium radulans		0.1	0.2		
**Echinochloa colona*	Weed	0.1	0.2		
Eriachne obtusa		0.1	0.2		
Phyllanthus maderaspatensis		0.1	0.15		
Phyllanthus sp. Port Hedland Solar Farm		0.1	0.15		

Iseilema membranaceum	0.1	0.15
Paspalidium rarum	0.1	0.1
Eragrostis cumingii	0.1	0.1
Calandrinia stagnensis	0.1	0.08
Neptunia dimorphantha	0.1	0.07
Marsilea hirsuta	0.1	0.03

Site details			
Site	**SF009**	**Position (WGS84)**	-20.434617, 118.571986
Slope	gentle	**Topography**	creek
Soil colour	red-orange	**Soil texture**	sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (23 Mar 2021)			
Sample description	Isolated low *Acacia ampliceps* and *Eucalyptus victrix* trees over low sparse *Acacia stellaticeps*, *Pluchea tetranthera* and *Sesbania cannabina* shrubland over mid *Triodia epactia*, *T. secunda* and *Chrysopogon fallax* grassland.		
Habitat	spinifex grassland		
Disturbance	Litter, Weed infestation		
Vegetation condition	Very Good	**Fire age**	
Total veg. cover (%)	70	**Tree cover (%)**	2
Shrub cover (%)	5	**Grass cover (%**	65
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	23-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (31)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		55	0.5		
Chrysopogon fallax		5	1		
Triodia secunda		5	0.3		
Sesbania cannabina		2	0.6		
Acacia stellaticeps		2	0.5		
Eucalyptus victrix		1	2		
Acacia ampliceps		1	2		
Cassytha capillaris		1	0.5		
Pluchea tetranthera		1	0.4		
Acacia colei var. *colei*		0.1	1.5		
Pluchea ferdinandi-muelleri		0.1	0.6		
Aristida holathera		0.1	0.5		
Eriachne obtusa		0.1	0.4		
**Cenchrus ciliaris*	Weed	0.1	0.4		
**Chloris virgata*	Weed	0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Acacia inaequilatera		0.1	0.3		
Pluchea rubelliflora		0.1	0.3		
Afrohybanthus aurantiacus		0.1	0.2		
Goodenia lamprosperma		0.1	0.2		
Eriachne aristidea		0.1	0.2		
Euphorbia biconvexa		0.1	0.2		
Fimbristylis dichotoma		0.1	0.2		
Dactyloctenium radulans		0.1	0.15		
Murdannia graminea		0.1	0.15		
Sporobolus australasicus		0.1	0.15		
Byblis liniflora		0.1	0.1		
Ipomoea coptica		0.1	0.1		
Trianthema triquetrum		0.1	0.05		
Neptunia dimorphantha		0.1	0.03		
Ptilotus murrayi		0.1	0.01		

Site details			
Site	**SF011**	**Position (WGS84)**	-20.430364, 118.557511
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Low *Triodia epactia* and *T. secunda* hummock grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	55	**Tree cover (%)**	0
Shrub cover (%)	0.1	**Grass cover (%**	55
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (5)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		35	0.4		
Triodia secunda		20	0.25		
Eriachne obtusa		0.1	0.08		
Pluchea tetranthera				0.1	0.5
Murdannia graminea				0.1	0.15

Site details			
Site	**SF012**	**Position (WGS84)**	-20.440906, 118.570703
Slope	negligible	**Topography**	plain
Soil colour	red-brown	**Soil texture**	sand, sandy clay
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated low *Acacia stellaticeps*, *Pluchea ferdinandii-muelleri* and *P. tetranthera* shrubs over low *Triodia epactia* hummock grassland over isolated clumps of low *Calandrinia pentavalvis*, *Mitrasacme exserta* and *Murdannia graminea* forbs.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	4	**Grass cover (%**	40
Herb cover (%)	0.4		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		40	0.4		
Acacia stellaticeps		4	0.6		
Triodia secunda		0.5	0.2		
Pluchea tetranthera		0.1	0.5		
Pluchea ferdinandi-muelleri		0.1	0.5		
Cassytha capillaris		0.1	0.4		
Ptilotus fusiformis		0.1	0.4		
Hibiscus leptocladus		0.1	0.4		
Corchorus elachocarpus		0.1	0.25		
Murdannia graminea		0.1	0.2		
Mitrasacme exserta		0.1	0.2		
Senna notabilis		0.1	0.2		
Fimbristylis dichotoma		0.1	0.15		
Eriachne obtusa		0.1	0.15		
Stackhousia intermedia		0.1	0.15		
Polygala galeocephala		0.1	0.1		
Indigofera monophylla		0.1	0.1		
Byblis liniflora		0.1	0.06		
Calandrinia pentavalvis				0.1	0.1

Site details			
Site	**SF013**	**Position (WGS84)**	-20.428855, 118.553485
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Low sparse *Acacia stellaticeps*, *Pluchea tetranthera* and *P. ferdinandi-muelleri* shrubland over low *Triodia epactia* hummock grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	5	**Grass cover (%**	35
Herb cover (%)	0.2		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (11)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		35	0.4		
Acacia stellaticeps		5	0.4		
Pluchea ferdinandi-muelleri		0.1	0.7		
Chrysopogon fallax		0.1	0.6		
Acacia dictyophleba		0.1	0.4		
Pluchea tetranthera		0.1	0.3		
Eriachne obtusa		0.1	0.3		
Portulaca decipiens		0.1	0.25		
Abildgaardia oxystachya		0.1	0.25		
Polygala galeocephala		0.1	0.05		
Tribulopis angustifolia		0.1	0.02		

Site details			
Site	**SF014**	**Position (WGS84)**	-20.429214, 118.554175
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated tall *Acacia tumida* var. *pilbarensis* and *A. colei* var. *colei* shrubs over mid *Acacia stellaticeps* and *Corchorus incanus* subsp. *incanus* shrubland over mid *Triodia epactia* hummock grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	55	**Tree cover (%)**	4
Shrub cover (%)	40	**Grass cover (%**	20
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	25-Mar-2021	unbounded	Grant Wells
Relevé	2	15-Sep-2021	unbounded	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		40	1.2		
Triodia epactia		20	0.5		
Acacia tumida var. *pilbarensis*		2	2.2		
Cassytha capillaris		0.5	0.4		
Corchorus incanus subsp. *incanus*		0.2	0.5		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.7		
Pluchea ferdinandi-muelleri		0.1	0.6		
Chrysopogon fallax		0.1	0.6		
Triodia schinzii		0.1	0.5		
Ptilotus polystachyus		0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Bonamia linearis		0.1	0.4		
Eragrostis eriopoda		0.1	0.3		
Waltheria indica		0.1	0.3		
Portulaca decipiens		0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Evolvulus alsinoides var. *decumbens*		0.1	0.25		
Acacia colei var. *colei*				2	2.2

Site details			
Site	**SF015**	**Position (WGS84)**	-20.431267, 118.558104
Slope	negligible	**Topography**	plain
Soil colour	red-brown	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (23 Mar 2021)			
Sample description	Low *Corymbia candida* subsp. *lautifolia* woodland over tall open *Acacia tumida* var. *pilbarensis* and *A .colei* var. *colei* shrubland over low open *Acacia stellaticeps* and *Bonamia erecta* shrubland over mid *Triodia epactia* and *Chrysopogon fallax* grassland.		
Habitat	shrubland		
Disturbance	Weed infestation		
Vegetation condition	Very Good	**Fire age**	
Total veg. cover (%)	60	**Tree cover (%)**	12
Shrub cover (%)	15	**Grass cover (%**	55
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	23-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (32)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		45	0.5		
Chrysopogon fallax		15	0.8		
Corymbia candida subsp. *lautifolia*		10	3		
Acacia tumida var. *pilbarensis*		10	2.5		
Acacia stellaticeps		10	1		
Bonamia erecta		5	0.5		
Acacia colei var. *colei*		2	3		
Corchorus incanus subsp. *incanus*		2	0.5		
Aristida holathera		0.2	0.6		
Afrohybanthus aurantiacus		0.2	0.5		
Hibiscus leptocladus		0.2	0.4		
Acacia sericophylla		0.1	2.5		
Grevillea pyramidalis subsp. *leucadendron*		0.1	1.5		
Eriachne obtusa		0.1	0.5		
Cucumis variabilis		0.1	0.5		
Eragrostis eriopoda		0.1	0.5		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.5		
Waltheria indica		0.1	0.5		
Solanum lasiophyllum		0.1	0.5		
**Cenchrus ciliaris*	Weed	0.1	0.5		
Senna notabilis		0.1	0.5		
Sida rohlenae subsp. *rohlenae*		0.1	0.4		
Sida sp. Pindan (B.G. Thomson 3398)		0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Rhynchosia minima		0.1	0.3		
Ptilotus polystachyus		0.1	0.3		
Digitaria brownii		0.1	0.3		
Solanum diversiflorum		0.1	0.3		
Operculina aequisepala		0.1	0.3		
Solanum cleistogamum		0.1	0.25		
Evolvulus alsinoides var. *decumbens*		0.1	0.2		
Bonamia pilbarensis		0.1	0.05		

Site details			
Site	**SF016**	**Position (WGS84)**	-20.446295, 118.564682
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Emergent isolated mid to tall *Acacia tumida* var. *pilbarensis* shrubs over low open *Acacia stellaticeps*, *Sida* sp. Pindan and *Senna notabilis* shrubland over low sparse *Triodia epactia*, *Aristida holathera* and *Chrysopogon fallax* grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	recent (<1 year)
Total veg. cover (%)	20	**Tree cover (%)**	0
Shrub cover (%)	12	**Grass cover (%**	8
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (28)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		5	0.2		
Aristida holathera		4	0.4		
Sida sp. Pindan (B.G. Thomson 3398)		3	0.4		
Triodia epactia		3	0.15		
Senna notabilis		2	0.3		
Chrysopogon fallax		1	0.5		
Acacia tumida var. *pilbarensis*		0.5	0.5		
Hibiscus leptocladus		0.5	0.4		
Yakirra australiensis var. *australiensis*		0.5	0.15		
Eragrostis eriopoda		0.1	0.4		
Corchorus incanus subsp. *incanus*		0.1	0.4		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Goodenia microptera		0.1	0.4		
Corchorus elachocarpus		0.1	0.3		
Cleome uncifera		0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)		0.1	0.3		
Bonamia alatisemina		0.1	0.2		
Solanum diversiflorum		0.1	0.2		
Leptosema anomalum		0.1	0.2		
Bonamia pannosa		0.1	0.15		
Eriachne aristidea		0.1	0.15		
Polygala galeocephala		0.1	0.1		
Tribulopis angustifolia		0.1	0.1		
Trianthema pilosum		0.1	0.05		
Bonamia media		0.1	0.01		
Fimbristylis simulans				0.1	0.1

Site details			
Site	**SF017**	**Position (WGS84)**	-20.448278, 118.572607
Slope	gentle	**Topography**	floodplain
Soil colour	red-orange	**Soil texture**	sand, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated low *Corchorus elachocarpus* shrubs over low *Triodia epactia*, *T. secunda* and *Eriachne obtusa* grassland over isolated clumps of low compact *Calandrinia stagnensis*, *C. tepperiana* and *Byblis liniflora* forbs.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	30	**Tree cover (%)**	0
Shrub cover (%)	2	**Grass cover (%**	30
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		15	0.4		
Triodia secunda		10	0.25		
Eriachne obtusa		5	0.2		
Corchorus elachocarpus		2	0.3		
Eriachne sulcata		0.2	0.15		
Murdannia graminea		0.15	0.2		
Goodenia microptera		0.1	0.3		
Senna notabilis		0.1	0.25		
Ptilotus calostachyus		0.1	0.2		
Fimbristylis dichotoma		0.1	0.2		
Stemodia grossa		0.1	0.2		
Eriachne aristidea		0.1	0.2		
Trianthema triquetrum		0.1	0.2		
Calandrinia tepperiana		0.1	0.15		
Sporobolus australasicus		0.1	0.1		
Heliotropium cunninghamii		0.1	0.08		
Byblis liniflora		0.1	0.06		
Calandrinia stagnensis		0.1	0.05		
Streptoglossa odora				0.1	0.25

Site details			
Site	**SF018**	**Position (WGS84)**	-20.444953, 118.573127
Slope	gentle	**Topography**	floodplain
Soil colour	red-orange	**Soil texture**	sand, sandy clay
Rock cover (%)	0	**Rock type**	None

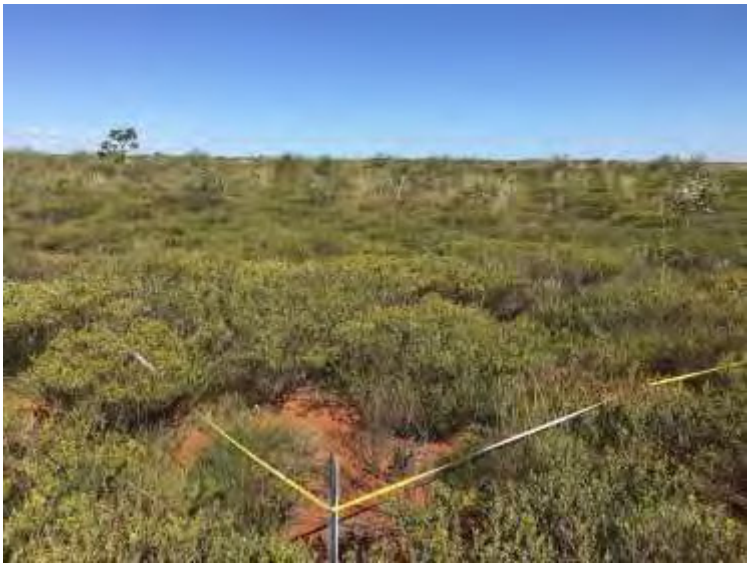
Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated clumps of low *Acacia stellaticeps* and *Pluchea tetranthera* shrubs over low *Triodia epactia*, *T. secunda* and *Eriachne sulcata* grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	30	**Tree cover (%)**	0
Shrub cover (%)	0.2	**Grass cover (%**	30
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (18)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		20	0.4		
Triodia secunda		10	0.4		
Paspalidium rarum		1	0.15		
Eriachne sulcata		1	0.1		
Aristida holathera		0.1	0.4		
Acacia stellaticeps		0.1	0.4		
Eriachne aristidea		0.1	0.2		
Fimbristylis dichotoma		0.1	0.15		
Mitrasacme exserta		0.1	0.15		
Trianthema triquetrum		0.1	0.15		
Eriachne obtusa		0.1	0.15		
Yakirra australiensis var. *australiensis*		0.1	0.1		
Calandrinia tepperiana		0.1	0.1		
Bulbostylis barbata		0.1	0.08		
Byblis liniflora		0.1	0.05		
Calandrinia stagnensis		0.1	0.03		
Pluchea tetranthera				0.1	0.5
Eragrostis dielsii				0.1	0.02

Site details			
Site	**SF019**	**Position (WGS84)**	-20.437699, 118.554506
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated mid *Acacia tumida* var *pilbarensis* shrubs over low closed *Acacia stellaticeps*, *Corchorus incanus* subsp. *incanus* and *Ptilotus astrolasius* shrubland over low open *Triodia epactia* and *T. schinzii* grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	80	**Tree cover (%)**	4
Shrub cover (%)	60	**Grass cover (%**	25
Herb cover (%)	0.2		



Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	15-Sep-2021	50m x 50m	Grant Wells

Species (24)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		55	0.6		
Triodia epactia		20	0.4		
Acacia tumida var. *pilbarensis*		4	2		
Ptilotus astrolasius		3	0.4		
Triodia schinzii		2	0.5		
Corchorus incanus subsp. *incanus*		1	0.4		
Cassytha capillaris		1	0.3		
Bonamia erecta		0.2	0.4		
Owenia reticulata		0.1	3		
Acacia sericophylla		0.1	1		
Dodonaea coriacea		0.1	0.6		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.5		
Chrysopogon fallax		0.1	0.5		
Corchorus elachocarpus		0.1	0.5		
Triumfetta chaetocarpa		0.1	0.4		
Indigofera monophylla		0.1	0.4		
Paraneurachne muelleri		0.1	0.4		
Hibiscus sturtii var. *campylochlamys*		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.3		
Eragrostis eriopoda		0.1	0.3		
Leptosema anomalum		0.1	0.25		
Evolvulus alsinoides var. *decumbens*		0.1	0.15		
Tribulopis angustifolia		0.1	0.1		
Bonamia linearis		0.1	0.05		

Site details			
Site	**SF020**	**Position (WGS84)**	-20.434184, 118.55824
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Isolated low *Acacia stellaticeps*, *Pluchea tetranthera* and *Ptilotus fusiformis* shrubs over low *Triodia epactia* hummock grassland over isolated low *Byblos liniflora*, *Bulbostylis barbata* and *Calandrinia stagnensis* forbs.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	1	**Grass cover (%**	40
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		40	0.4		
Acacia stellaticeps		1	0.3		
Afrohybanthus aurantiacus		0.1	0.5		
Cassytha capillaris		0.1	0.4		
Ptilotus fusiformis		0.1	0.4		
Bonamia erecta		0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Fimbristylis dichotoma		0.1	0.2		
Abildgaardia oxystachya		0.1	0.15		
Eriachne obtusa		0.1	0.15		
Mitrasacme exserta		0.1	0.15		
Eriachne aristidea		0.1	0.15		
Stackhousia intermedia		0.1	0.1		
Byblis liniflora		0.1	0.07		
Asteraceae sp.		0.1	0.06		
Bulbostylis barbata		0.1	0.05		
Polygala galeocephala		0.1	0.03		
Calandrinia stagnensis		0.1	0.02		
Ptilotus astrolasius				0.1	0.4

Site details			
Site	**SF021**	**Position (WGS84)**	-20.439772, 118.563326
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Emergent mid to tall open *Acacia tumida* var. *pilbarensis* shrubland over low *Acacia stellaticeps*, *Bonamia erecta* and *Senna notabilis* shrubland over low open *Aristida holathera*, *Triodia epactia* and *Paraneurachne muelleri* grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	recent (<1 year)
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	30	**Grass cover (%**	20
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (38)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		15	0.2		
Aristida holathera		10	0.5		
Bonamia erecta		10	0.3		
Triodia epactia		10	0.2		
Senna notabilis		5	0.3		
Sida sp. Pindan (B.G. Thomson 3398)		2	0.4		
Acacia tumida var. *pilbarensis*		1	0.8		
Indigofera monophylla		1	0.4		
Hibiscus leptocladus		0.5	0.4		
Tribulopis angustifolia		0.5	0.1		
Paraneurachne muelleri		0.2	0.4		
Corchorus incanus subsp. *incanus*		0.1	0.6		
Ptilotus polystachyus		0.1	0.5		
Triodia schinzii		0.1	0.5		
Chrysopogon fallax		0.1	0.5		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.5		
Eriachne obtusa		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Solanum lasiophyllum		0.1	0.4		
Eragrostis eriopoda		0.1	0.4		
Ptilotus astrolasius		0.1	0.4		
Ptilotus fusiformis		0.1	0.3		
Solanum diversiflorum		0.1	0.25		
Evolvulus alsinoides var. *decumbens*		0.1	0.25		
Abildgaardia oxystachya		0.1	0.25		
Triodia lanigera		0.1	0.25		
Leptosema anomalum		0.1	0.2		
Mollugo molluginea		0.1	0.2		
Calandrinia tepperiana		0.1	0.2		
Eriachne aristidea		0.1	0.15		
Calandrinia pentavalvis		0.1	0.1		
Euphorbia biconvexa		0.1	0.08		
Yakirra australiensis var. *australiensis*		0.1	0.08		
Bulbostylis barbata		0.1	0.07		
Polygala galeocephala		0.1	0.03		
Polymeria ambigua		0.1	0.02		
Bonamia alatisemina		0.1	0.02		
Bonamia media		0.1	0.02		

Site details			
Site	**SF022**	**Position (WGS84)**	-20.436871, 118.566298
Slope	gentle	**Topography**	undulating plain
Soil colour	red-brown	**Soil texture**	sand, sandy clay
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated clumps of low *Pluchea tetranthera* and *Senna notabilis* shrubs over low *Triodia epactia*, *T. secunda* and *Eriachne sulcata* grassland over isolated clumps of low *Mitrasacme exserta*, *Murdanni graminea* and *Calandrinia stagnensis* forbs.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	45	**Tree cover (%)**	0
Shrub cover (%)	0.2	**Grass cover (%**	45
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	25-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (23)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		35	0.4		
Triodia secunda		7	0.25		
Eriachne sulcata		3	0.15		
Calandrinia stagnensis		0.2	0.05		
Pluchea tetranthera		0.1	0.3		
Senna notabilis		0.1	0.25		
Fimbristylis dichotoma		0.1	0.2		
Murdannia graminea		0.1	0.2		
Fimbristylis rara		0.1	0.2		
Stackhousia intermedia		0.1	0.2		
Mitrasacme exserta		0.1	0.2		
Calandrinia pentavalvis		0.1	0.15		
Calandrinia tepperiana		0.1	0.15		
Eriachne obtusa		0.1	0.15		
Eriachne aristidea		0.1	0.1		
Bulbostylis barbata		0.1	0.1		
Byblis liniflora		0.1	0.05		
Heliotropium cunninghamii		0.1	0.05		
Schoenoplectiella laevis		0.1	0.05		
Synaptantha tillaeacea		0.1	0.05		
Calandrinia pumila		0.1	0.03		
Marsilea hirsuta		0.1	0.02		
Peplidium muelleri		0.1	0.01		

Site details			
Site	**SF024**	**Position (WGS84)**	-20.440958, 118.569387
Slope	gentle	**Topography**	undulating plain
Soil colour	red-brown	**Soil texture**	sand, sandy clay
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (26 Mar 2021)			
Sample description	Low *Triodia epactia*, *T. secunda* and *Eriachne sulcata* grassland over isolated clumps of low *Byblis liniflora*, *Murdannia* graminea and *Mitrasacme exserta* forbs		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	30	**Tree cover (%)**	0
Shrub cover (%)	0.5	**Grass cover (%**	30
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	26-Mar-2021	unbounded	Grant Wells
Relevé	2	14-Sep-2021	unbounded	Grant Wells

Species (16)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		20	0.4		
Triodia secunda		6	0.25		
Eriachne sulcata		4	0.1		
Eragrostis cumingii		0.1	0.4		
Fimbristylis rara		0.1	0.3		
Eriachne obtusa		0.1	0.2		
Murdannia graminea		0.1	0.2		
Fimbristylis dichotoma		0.1	0.15		
Mitrasacme exserta		0.1	0.15		
Stackhousia intermedia		0.1	0.15		
Schoenoplectiella laevis		0.1	0.1		
Cyperus pulchellus		0.1	0.1		
Cyperus squarrosus		0.1	0.08		
Byblis liniflora		0.1	0.05		
Peplidium muelleri		0.1	0.01		
Marsilea hirsuta		0.1	0.01		

Site details			
Site	**SF026**	**Position (WGS84)**	-20.44718, 118.571597
Slope	gentle	**Topography**	floodplain
Soil colour	red-brown	**Soil texture**	sandy clay, clay loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (25 Mar 2021)			
Sample description	Isolated tall *Acacia inaequilatera* shrubs over sparse low *Acacia stellaticeps*, *Pluchea tetranthera* and *Senna notabilis* shrubland over low open *Triodia epactia* and *T. lanigera* hummock grassland.		
Habitat	shrubland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	30	**Tree cover (%)**	0.1
Shrub cover (%)	10	**Grass cover (%**	25
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	25-Mar-2021	unbounded	Grant Wells
Relevé	2	14-Sep-2021	unbounded	Grant Wells

Species (18)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		25	0.4		
Acacia stellaticeps		10	0.5		
Triodia lanigera		2	0.3		
Chrysopogon fallax		1	0.7		
Acacia inaequilatera		0.5	2.5		
Eragrostis eriopoda		0.1	0.4		
Senna notabilis		0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Paraneurachne muelleri		0.1	0.4		
Cassytha capillaris		0.1	0.3		
Corchorus elachocarpus		0.1	0.25		
Eriachne aristidea		0.1	0.2		
Fimbristylis dichotoma		0.1	0.15		
Bulbostylis barbata		0.1	0.06		
Bonamia alatisemina		0.1	0.05		
Polymeria calycina				0.1	0.1
Aristida holathera				0.1	0.4
Sida sp. Pilbara (A.A. Mitchell PRP 1543)				0.1	0.4

Site details			
Site	**SF028**	**Position (WGS84)**	-20.442097, 118.565806
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (24 Mar 2021)			
Sample description	Isolated clumps of low *Acacia stellaticeps*, *Hibiscus leptocladus* and *Senna notabilis* shrubs over low *Eriachne obtusa* and *Triodia epactia* grassland over isolated low *Bulbostylis barbata*, *Calandrinia stagnensis* and *Fimbristylis dichotoma* forbs.		
Habitat	grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	
Total veg. cover (%)	35	**Tree cover (%)**	0
Shrub cover (%)	0.2	**Grass cover (%**	35
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	24-Mar-2021	50m x 50m	Grant Wells
Quadrat	2	14-Sep-2021	50m x 50m	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Eriachne obtusa		20	0.2		
Triodia epactia		15	0.4		
Calandrinia pumila		0.2	0.03		
Aristida holathera		0.1	0.4		
Hibiscus leptocladus		0.1	0.3		
Fimbristylis dichotoma		0.1	0.3		
Sida sp. Pindan (B.G. Thomson 3398)		0.1	0.3		
Trianthema triquetrum		0.1	0.3		
Abildgaardia oxystachya		0.1	0.25		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.25		
Goodenia microptera		0.1	0.25		
Mitrasacme exserta		0.1	0.2		
Senna notabilis		0.1	0.2		
Acacia stellaticeps		0.1	0.2		
Ptilotus calostachyus		0.1	0.15		
Eragrostis dielsii		0.1	0.15		
Calandrinia stagnensis		0.1	0.05		
Byblis liniflora		0.1	0.04		
Polygala galeocephala		0.1	0.02		

Site details			
Site	**SF030**	**Position (WGS84)**	-20.435809, 118.571506
Slope	moderate	**Topography**	creek
Soil colour	red-brown	**Soil texture**	sand, clay loam, sandy loam
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (15 Sep 2021)			
Sample description	Isolated low *Eucalyptus victrix* trees over isolated mid *Acacia ampliceps* and *Hakea lorea* subsp. *lorea* shrubs over low open *Acacia stellaticeps* shrubland over *Triodia epactia* hummock grassland.		
Habitat	shrubland		
Disturbance	evidence of feral animals, weed infestation		
Vegetation condition	Very good	**Fire age**	old (5-10 years)
Total veg. cover (%)	65	**Tree cover (%)**	3
Shrub cover (%)	20	**Grass cover (%**	50
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	15-Sep-2021	unbounded	Grant Wells

Species (19)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		45	0.5		
Acacia stellaticeps		12	0.5		
Acacia ampliceps		2	2		
Eucalyptus victrix		1	7		
**Cenchrus ciliaris*	Weed	1	0.6		
Triodia secunda		1	0.3		
Cassytha capillaris		0.5	0.5		
Hakea lorea subsp. *lorea*		0.1	1.8		
Cyperus conicus		0.1	1.2		
Pluchea ferdinandi-muelleri		0.1	0.6		
Chrysopogon fallax		0.1	0.5		
Hybanthus aurantiacus		0.1	0.5		
Pluchea tetranthera		0.1	0.5		
Ptilotus fusiformis		0.1	0.4		
Eragrostis speciosa		0.1	0.3		
Pluchea rubelliflora		0.1	0.3		
Phyllanthus maderaspatensis		0.1	0.2		
Eragrostis cumingii		0.1	0.15		
Marsilea hirsuta		0.1	0.02		

Site details			
Site	**SF031**	**Position (WGS84)**	-20.430835, 118.569434
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sand, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (15 Sep 2021)			
Sample description	Low open *Acacia stellaticeps*, *Pluchea tetranthera* and *P. ferdinandi-muelleri* shrubland over low *Triodia epactia* and *T. secunda* hummock grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	10	**Grass cover (%**	30
Herb cover (%)	0		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	15-Sep-2021	unbounded	Grant Wells

Species (7)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		28	0.25		
Acacia stellaticeps		7	0.4		
Pluchea tetranthera		2	0.5		
Triodia secunda		2	0.2		
Pluchea ferdinandi-muelleri		1	0.5		
Cassytha filiformis		0.1	0.2		
Eriachne obtusa		0.1	0.1		

Site details			
Site	**SF032**	**Position (WGS84)**	-20.429569, 118.563679
Slope	negligible	**Topography**	plain
Soil colour	red-brown	**Soil texture**	sandy clay, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (15 Sep 2021)			
Sample description	Low sparse *Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* shrubland over *Triodia epactia* hummock grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	relatively recent (1-5 years)
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	8	**Grass cover (%**	32
Herb cover (%)	0		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	15-Sep-2021	unbounded	Grant Wells

Species (3)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		32	0.25		
Pluchea ferdinandi-muelleri		6	0.6		
Acacia stellaticeps		2	0.5		

Site details			
Site	**SF033**	**Position (WGS84)**	-20.428751, 118.559527
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	sandy clay, sandy loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (15 Sep 2021)			
Sample description	Isolated clumps of low *Pluchea ferdinandi-muelleri* shrubs over low *Triodia epactia* and *T. secunda* hummock grassland.		
Habitat	spinifex grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	relatively recent (1-5 years)
Total veg. cover (%)	60	**Tree cover (%)**	0
Shrub cover (%)	0.1	**Grass cover (%**	60
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	15-Sep-2021	unbounded	Grant Wells

Species (4)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		55	0.4		
Triodia secunda		5	0.3		
Pluchea ferdinandi-muelleri		0.1	0.6		
Fimbristylis dichotoma		0.1	0.2		

Site details			
Site	**SF034**	**Position (WGS84)**	-20.436953, 118.566183
Slope	gentle	**Topography**	depression
Soil colour	brown	**Soil texture**	sandy clay, clay loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (14 Sep 2021)			
Sample description	Low open *Eriachne sulcata* grassland over isolated clumps of low *Marsilea hirsuta*, *Calandrinia pumila* and *Peplidium muelleri* forbs.		
Habitat	grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	not evident
Total veg. cover (%)	10	**Tree cover (%)**	0
Shrub cover (%)	0	**Grass cover (%**	10
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	14-Sep-2021	unbounded	Grant Wells

Species (6)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Eriachne sulcata		10	0.2		
Marsilea hirsuta		0.2	0.04		
Peplidium muelleri		0.2	0.02		
Eriachne obtusa		0.1	0.15		
Byblis liniflora		0.1	0.1		
Calandrinia pumila		0.1	0.01		

Site details			
Site	**SF035**	**Position (WGS84)**	-20.440906, 118.569421
Slope	gentle	**Topography**	depression
Soil colour	brown	**Soil texture**	sandy clay, clay loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (14 Sep 2021)			
Sample description	Low open *Eriachne sulcata* grassland over isolated clumps of *Marsilea hirsuta*, *Peplidium muelleri* and *Byblis liniflora* forbs.		
Habitat	grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	not evident
Total veg. cover (%)	11	**Tree cover (%)**	0
Shrub cover (%)	0	**Grass cover (%**	10
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	14-Sep-2021	unbounded	Grant Wells

Species (4)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Eriachne sulcata		10	0.2		
Marsilea hirsuta		0.8	0.01		
Byblis liniflora		0.1	0.1		
Peplidium muelleri		0.1	0.01		

Site details			
Site	**SF036**	**Position (WGS84)**	-20.437632, 118.566608
Slope	gentle	**Topography**	depression
Soil colour	brown	**Soil texture**	sandy clay, clay loam
Rock cover (%)	0	**Rock type**	None

Observation details - visit 1 (14 Sep 2021)			
Sample description	Isolated low *Eriachne sulcata* grasses over isolated clumps of low *Calandrinia stagnensis* and *Peplidium muelleri* forbs.		
Habitat	grassland		
Disturbance	None evident		
Vegetation condition	Excellent	**Fire age**	not evident
Total veg. cover (%)	2	**Tree cover (%)**	0
Shrub cover (%)	0	**Grass cover (%**	2
Herb cover (%)	0.2		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	14-Sep-2021	unbounded	Grant Wells

Species (3)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Eriachne sulcata		2	0.2		
Peplidium muelleri		0.1	0.01		
Calandrinia stagnensis		0.1	0.01		

Appendix 3 NVIS hierarchy

Western Australia Current Practice			National Standard		
Hierarchy of terms	**Brief description in WA**	**Indicative scale**	**NVIS Level**	**Description**	**NVIS structural/floristic components required**
Vegetation formation	Structure and growth form – e.g. Forest, Woodland.	1:5 000 000	I	Class	Dominant growth form for the ecologically or structurally dominant stratum.
Vegetation sub-formation	Structural and dominant vegetation layer - Eucalypt Forest, Banksia Woodland	1:2 500 000 I	II	Structural Formation	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
Vegetation association	Structural form and dominant species – e.g. Medium woodland; York gum (*Eucalyptus loxophleba*) & Wandoo	1:1 000 000 to 1:250 000	III	Broad Floristic Formation	Dominant growth form, cover, height and dominant land cover genus for the uppermost or dominant stratum.
Vegetation complex	Structural and floristic description linked to geomorphology – e.g. Quindalup Complex.	1:250 000 to 1:100 000	IV	Sub-Formation	Dominant growth form, cover, height and dominant genus and Family for the three traditional strata. (i.e. Upper, Mid and Ground).
Vegetation type	Floristic definition by strata with structural detail. Often represented with a code and floristic description.	1:100 000 to 1:10 000	V	Association	Dominant growth form, height, cover and up to 3 species for the three traditional strata. (i.e. Upper, Mid and Ground).
Plant community	Basic unit of vegetation classification, site specific and highly localised with detailed floristics for each stratum.	1:10 000	VI	Sub-Association	Dominant growth form, height, cover and up to 5 species for all layers/ strata.
Floristic Community Type	Floristic composition definition; e.g. Northern banksia woodlands over herb rich shrublands on the Swan Coastal Plain.	No absolute scale			

Appendix 4 Introduced flora identified in the desktop review

Species	Declared Pest	Weed of National Significance
**Aerva javanica*		
**Argemone ochroleuca* subsp. *ochroleuca*		
**Aristida contorta*		
**Calotropis procera*	X	
**Cenchrus ciliaris*		
**Cenchrus setaceus*		
**Cenchrus setiger*		
**Chloris barbata*		
**Chloris virgata*		
**Citrullus amarus*		
**Clitoria ternatea*		
**Coccinia grandis*		
**Conyza bonariensis*		
**Cyanthillium cinereum* var. *cinereum*		
**Dactyloctenium aegyptium*		
**Desmodium scorpiurus*		
**Digitaria ciliaris*		
**Distimake dissectus* var. *dissectus*		
**Echinochloa colona*		
**Eragrostis minor*		
**Eragrostis pilosa*		
**Euphorbia tirucalli*		
**Flaveria trinervia*		
**Gomphrena celosioides*		
**Gossypium hirsutum*		
**Indigofera hochstetteri*		
**Indigofera oblongifolia*		
**Indigofera sessiliflora*		
**Jatropha gossypiifolia*		
**Lamarckia aurea*		
**Leucaena leucocephala*		

**Opuntia stricta*	X	
**Parkinsonia aculeata*		
**Paspalum fasciculatum*		
**Passiflora foetida* var. *hispida*		
**Physalis angulata*		
**Portulaca pilosa*		
**Pupalia lappacea*		
**Senna occidentalis*		
**Setaria sphacelata*		
**Stylosanthes guianensis* var. *guianensis*		
**Stylosanthes hamata*		
**Symphyotrichum squamatum*		
**Tamarix aphylla*	X	X
**Tridax procumbens*		

Appendix 5 Flora species inventory

Family	Species
Aizoaceae	*Trianthema pilosum*
Aizoaceae	*Trianthema triquetrum*
Amaranthaceae	**Aerva javanica*
Amaranthaceae	*Alternanthera angustifolia*
Amaranthaceae	*Ptilotus astrolasius*
Amaranthaceae	*Ptilotus calostachyus*
Amaranthaceae	*Ptilotus fusiformis*
Amaranthaceae	*Ptilotus murrayi*
Amaranthaceae	*Ptilotus polystachyus*
Apocynaceae	*Carissa lanceolata*
Asteraceae	*Pluchea ferdinandi-muelleri*
Asteraceae	*Pluchea rubelliflora*
Asteraceae	*Pluchea tetranthera*
Asteraceae	*Streptoglossa decurrens*
Asteraceae	*Streptoglossa odora*
Bignoniaceae	*Dolichandrone occidentalis*
Boraginaceae	*Heliotropium cunninghamii*
Boraginaceae	*Heliotropium foliatum*
Byblidaceae	*Byblis liniflora*
Celastraceae	*Stackhousia intermedia*
Cleomaceae	*Arivela uncifera*
Cleomaceae	*Arivela viscosa*
Commelinaceae	*Murdannia graminea*
Convolvulaceae	*Bonamia alatisemina*
Convolvulaceae	*Bonamia erecta*
Convolvulaceae	*Bonamia linearis*
Convolvulaceae	*Bonamia media*
Convolvulaceae	*Bonamia pannosa*
Convolvulaceae	*Bonamia pilbarensis*
Convolvulaceae	*Distimake davenportii*
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*
Convolvulaceae	*Ipomoea coptica*
Convolvulaceae	*Ipomoea muelleri*
Convolvulaceae	*Operculina aequisepala*
Convolvulaceae	*Polymeria ambigua*
Convolvulaceae	*Polymeria calycina*
Cucurbitaceae	*Cucumis variabilis*
Cyperaceae	*Abildgaardia oxystachya*
Cyperaceae	*Bulbostylis barbata*
Cyperaceae	*Cyperus conicus*
Cyperaceae	*Cyperus pulchellus*
Cyperaceae	*Cyperus squarrosus*

Cyperaceae	*Fimbristylis dichotoma*
Cyperaceae	*Fimbristylis neilsonii*
Cyperaceae	*Fimbristylis rara*
Cyperaceae	*Fimbristylis simulans*
Cyperaceae	*Schoenoplectiella laevis*
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*
Euphorbiaceae	*Euphorbia biconvexa*
Euphorbiaceae	*Euphorbia vaccaria* var. *vaccaria*
Fabaceae	**Stylosanthes hamata*
Fabaceae	*Acacia ampliceps*
Fabaceae	*Acacia colei* var. *colei*
Fabaceae	*Acacia dictyophleba*
Fabaceae	*Acacia inaequilatera*
Fabaceae	*Acacia sericophylla*
Fabaceae	*Acacia stellaticeps*
Fabaceae	*Acacia tumida* var. *pilbarensis*
Fabaceae	*Crotalaria cunninghamii*
Fabaceae	*Grona filiformis*
Fabaceae	*Indigofera linifolia*
Fabaceae	*Indigofera monophylla*
Fabaceae	*Leptosema anomalum*
Fabaceae	*Neptunia dimorphantha*
Fabaceae	*Rhynchosia minima*
Fabaceae	*Senna notabilis*
Fabaceae	*Sesbania cannabina*
Fabaceae	*Tephrosia densa*
Fabaceae	*Tephrosia simplicifolia*
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601)
Goodeniaceae	*Goodenia forrestii*
Goodeniaceae	*Goodenia lamprosperma*
Goodeniaceae	*Goodenia microptera*
Lauraceae	*Cassytha capillaris*
Lauraceae	*Cassytha filiformis*
Loganiaceae	*Mitrasacme exserta*
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)
Malvaceae	*Abutlion lepidum*
Malvaceae	*Corchorus elachocarpus*
Malvaceae	*Corchorus incanus* subsp. *incanus*
Malvaceae	*Gossypium australe*
Malvaceae	*Hibiscus brachychlaenus*
Malvaceae	*Hibiscus leptocladus*
Malvaceae	*Hibiscus sturtii* var. *campylochlamys*
Malvaceae	*Seringia nephrosperma*
Malvaceae	*Sida rohlenae* subsp. *rohlenae*

Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)
Malvaceae	*Sida* sp. Pindan (B.G. Thomson 3398)
Malvaceae	*Triumfetta chaetocarpa*
Malvaceae	*Waltheria indica*
Marsileaceae	*Marsilea hirsuta*
Meliaceae	*Owenia reticulata*
Molluginaceae	*Trigastrotheca molluginea*
Montiaceae	*Calandrinia pentavalvis*
Montiaceae	*Calandrinia pumila*
Montiaceae	*Calandrinia stagnensis*
Montiaceae	*Calandrinia tepperiana*
Myrtaceae	*Corymbia candida* subsp. *lautifolia*
Myrtaceae	*Eucalyptus victrix*
Nyctaginacae	*Boerhavia coccinea*
Phrymaceae	*Peplidium muelleri*
Phyllanthaceae	*Phyllanthus* aff. *erwinii*
Phyllanthaceae	*Phyllanthus maderaspatensis*
Plataginaceae	*Stemodia grossa*
Poaceae	**Cenchrus ciliaris*
Poaceae	**Chloris virgata*
Poaceae	**Cynodon dactylon*
Poaceae	**Echinochloa colona*
Poaceae	*Aristida holathera*
Poaceae	*Aristida hygrometrica*
Poaceae	*Aristida inaequiglumis*
Poaceae	*Chrysopogon fallax*
Poaceae	*Dactyloctenium radulans*
Poaceae	*Digitaria brownii*
Poaceae	*Eragrostis cumingii*
Poaceae	*Eragrostis dielsii*
Poaceae	*Eragrostis eriopoda*
Poaceae	*Eragrostis speciosa*
Poaceae	*Eriachne aristidea*
Poaceae	*Eriachne helmsii*
Poaceae	*Eriachne obtusa*
Poaceae	*Eriachne sulcata*
Poaceae	*Eulalia aurea*
Poaceae	*Iseilema membranaceum*
Poaceae	*Paraneurachne muelleri*
Poaceae	*Paspalidium rarum*
Poaceae	*Sporobolus australasicus*
Poaceae	*Triodia epactia*
Poaceae	*Triodia lanigera*
Poaceae	*Triodia schinzii*

Poaceae	*Triodia secunda*
Poaceae	*Urochloa holosericea* subsp. *velutina*
Poaceae	*Yakirra australiensis* var. *australiensis*
Polygalaceae	*Polygala galeocephala*
Portulacaceae	*Portulaca decipiens*
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*
Proteaceae	*Hakea lorea* subsp. *lorea*
Rubiaceae	*Synaptantha tillaeacea*
Sapindaceae	*Dodonaea coriacea*
Solonaceae	*Solanum cleistogamum*
Solonaceae	*Solanum diversiflorum*
Solonaceae	*Solanum lasiophyllum*
Thymelaeaceae	*Pimelea ammocharis*
Violaceae	*Afrohybanthus aurantiacus*
Zygophyllaceae	*Tribulopis angustifolia*
Zygophyllaceae	*Tribulus hirsutus*