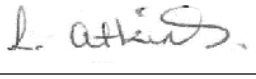
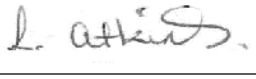
MCPHEE CREEK FLORA AND VEGETATION SURVEY

Atlas Iron

ecoscape

Revision	Author	QA Reviewer	Approved	Date
draft rev0	James Tsakalos	 LYN ATKINS PRINCIPAL ECOLOGIST	 LYN ATKINS PRINCIPAL ECOLOGIST	17/06/2020
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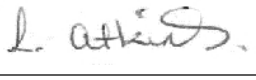
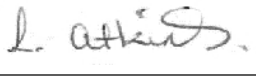
final rev1	James Tsakalos	 LYN ATKINS PRINCIPAL ECOLOGIST	 LYN ATKINS PRINCIPAL ECOLOGIST	31/07/2020
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ACKNOWLEDGEMENTS

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- Damien McAlinden, Principal Policy Development
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SUMMARY

Atlas Iron Limited (Atlas Iron) is proposing to conduct mining activities at the McPhee Creek iron ore deposit located near Nullagine in the Pilbara region of Western Australia. A number of flora and vegetation surveys have previously been conducted for Atlas Iron in or close to the McPhee Creek deposit, including three field surveys that intersect at least part of the current survey area. Ecoscape was appointed to collate and consolidate previous flora and vegetation data and mapping, conduct a gap analysis to inform a field survey, and conduct a field survey over a 6,055.55 ha area, incorporating previously surveyed areas and also some additional areas largely associated with proposed haul roads, with resultant reporting and data.

The desktop assessment, which incorporated the gap analysis, identified the following significant attributes and survey requirements:

- previous mapping was conducted at a level similar to NVIS Level VI; this was subsumed into Level V mapping (which is the level of detail recommended in the EPA 2016 Flora and Vegetation Technical Guidance) and, where there were possible mismatches, targeted for ground truthing
- there were topological errors, mis-matches in vegetation type mapping from different surveys in adjacent areas and artifacts in the mapping due to merging of data; these were corrected as much as possible during the desktop phase and areas for ground truthing identified
- merged vegetation types with insufficient quadrats to meet the Flora and Vegetation Technical Guidance requirements for Detailed surveys (ie less than 3 quadrats per vegetation type), and potential quadrat locations, were identified
- five conservation-listed flora (*Acacia aphanoclada* (P1), *Eragrostis crateriformis* (P3), *Goodenia nuda* (P4), *Ptilotus mollis* (P4) and *Rostellularia adscendens* var. *latifolia* (P3)) had previously been recorded in the survey area with significant amounts of grid searches conducted during previous surveys; areas of potential habitat, including previously unsurveyed areas, were targeted for searches
- riparian areas, where Groundwater Dependent Vegetation (GDV) or potential GDV has been previously identified, were reviewed and accessible areas that had not been groundtruthed identified for survey.

The desktop assessment and gap analysis informed the requirements for field survey, which was conducted over 11 days during April 2020. Previously surveyed creeklines to the southeast of the main body of the survey area were not accessed during the 2020 field survey; results for the creeklines have been interpolated from previous assessments. Part of a proposed haul road was not accessible at the time of survey due to asbestos contamination; the results from this section of the survey area were extrapolated from adjacent areas.

The significant activities and findings of the Detailed flora and vegetation field survey were:

- 182 quadrats have been recorded from within the survey area including 42 established during 2020
- 370 vascular flora species have been recorded from within the survey area
- three conservation-listed flora species (*Acacia aphanoclada* (P1), *Ptilotus mollis* (P4) and *Rostellularia adscendens* var. *latifolia* (P3)) had new populations recorded, all of which were known from elsewhere in the McPhee Creek area
- two previously recorded conservation-listed flora were not recorded during the 2020 field survey: *Eragrostis crateriformis* (P3) was considered likely to respond to seasonal conditions, thus may not always be present, and *Goodenia nuda* (P4) that was considered to possibly represent a mis-identification
- no additional conservation-listed species were considered likely to occur based on the habitat available within the survey area and the extent of searches conducted

- seven introduced species were recorded during 2020, including one species not previously recorded from the survey area (**Calotropis procera*, Rubber Bush, which is a Declared Pest plant); over all survey periods 16 introduced species have been recorded
- 19 vegetation types consolidated from data and ground truthed using a combination of structural vegetation types, floristic analysis and subsequent review
- no vegetation types were representative of any conservation-listed ecological communities
- no vegetation types were considered significant according to the Flora and Vegetation Technical Guidance as all were considered to be well represented in the region, although Groundwater Dependent Vegetation (GDV) may be considered significant (see next points)
- likely GDV characterised by *Eucalyptus camaldulensis* was identified from the creeklines to the southeast of the main survey area
- vegetation characterised by *Eucalyptus victrix* was also recorded from creeklines; this species may, depending on groundwater availability, be a vadophyte (i.e. not dependent on groundwater) or phreatophyte (relying on groundwater) – where groundwater was accessible (i.e. less than 10 m from the surface) this vegetation type was considered a potential GDV
- vegetation condition was largely (86%) in Excellent condition, with only 1.2% in Degraded condition; assessment of vegetation condition ratings was largely influenced by grazing and weed presence.

In 2022 the EPA requested additional information regarding some aspects of the survey. Ecoscape's response is included as an addendum to this report.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms and abbreviations	
agg.	Aggregate (of subtaxa); equivalent of *sens. lat.*
BAM Act	Western Australian *Biosecurity and Agriculture Management Act 2007*
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CALM	Western Australian Department of Conservation and Land Management (1985-2006, now DBCA)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAFWA	Department of Agriculture and Food, Western Australia (2006-2017, now DPIRD)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DotEE)
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DPIRD	Western Australian Department of Primary Industries and Rural Development
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DotEE)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian *Environmental Protection Act 1986*
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDA 94	Geographic Datum of Australia 1994
GDE, GDV	Groundwater Dependent Ecosystem, Groundwater Dependent Vegetation
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
MGA	Map Grid of Australia
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
SFDV	Sheet Flow Dependent Vegetation
SoW	Scope of Works
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
TEC	Threatened Ecological Community

Acronyms and abbreviations	
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WONS	Weeds of National Significance
Woodman	Woodman Environmental Consulting
*****	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

Atlas Iron Limited (Atlas Iron) is proposing to conduct mining activities at the McPhee Creek iron ore deposit, located in the Pilbara region of Western Australia, approximately 220 km north of Newman, 30 km north of Nullagine and 5 km east of the Marble Bar-Nullagine Road.

Various biological and heritage studies are required for referral under both State (*Environmental Protection Act 1986* (EP Act)) and Commonwealth (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) legislation. This report presents detailed flora and vegetation survey information for the McPhee Creek project area and associated riparian area, including compiling and updating information from Woodman Environmental Consulting's (Woodman 2019a) *McPhee Creek Iron Ore Project Detailed Flora and Vegetation Assessment* survey, included as **Appendix Seven**, and earlier surveys by the same consultant.

1.2 SURVEY AREA

The survey area occupies 6,055.55 ha and is located in the Pilbara region of Western Australia approximately 220 km north of Newman, approximately 30 km north of Nullagine and east of the Marble Bar-Nullagine Road (**Figure 1**), in the Shire of East Pilbara.

The survey incorporated McPhee Creek Project Area (excluding development area), proposed haul roads and riparian (creekline) mapping. The extents within this document are inclusive of the development envelope.

The proposed haul road alignments have altered since the field survey, in addition to some parts not being accessed at the time of survey due to asbestos contamination. This has required extrapolation of vegetation types in some areas that have not been subject to field survey. Additionally, the creeklines to the southeast of the survey area were not accessed during the field survey; the vegetation types have been interpolated from previous mapping, with review of previous quadrat data used as confirmation.

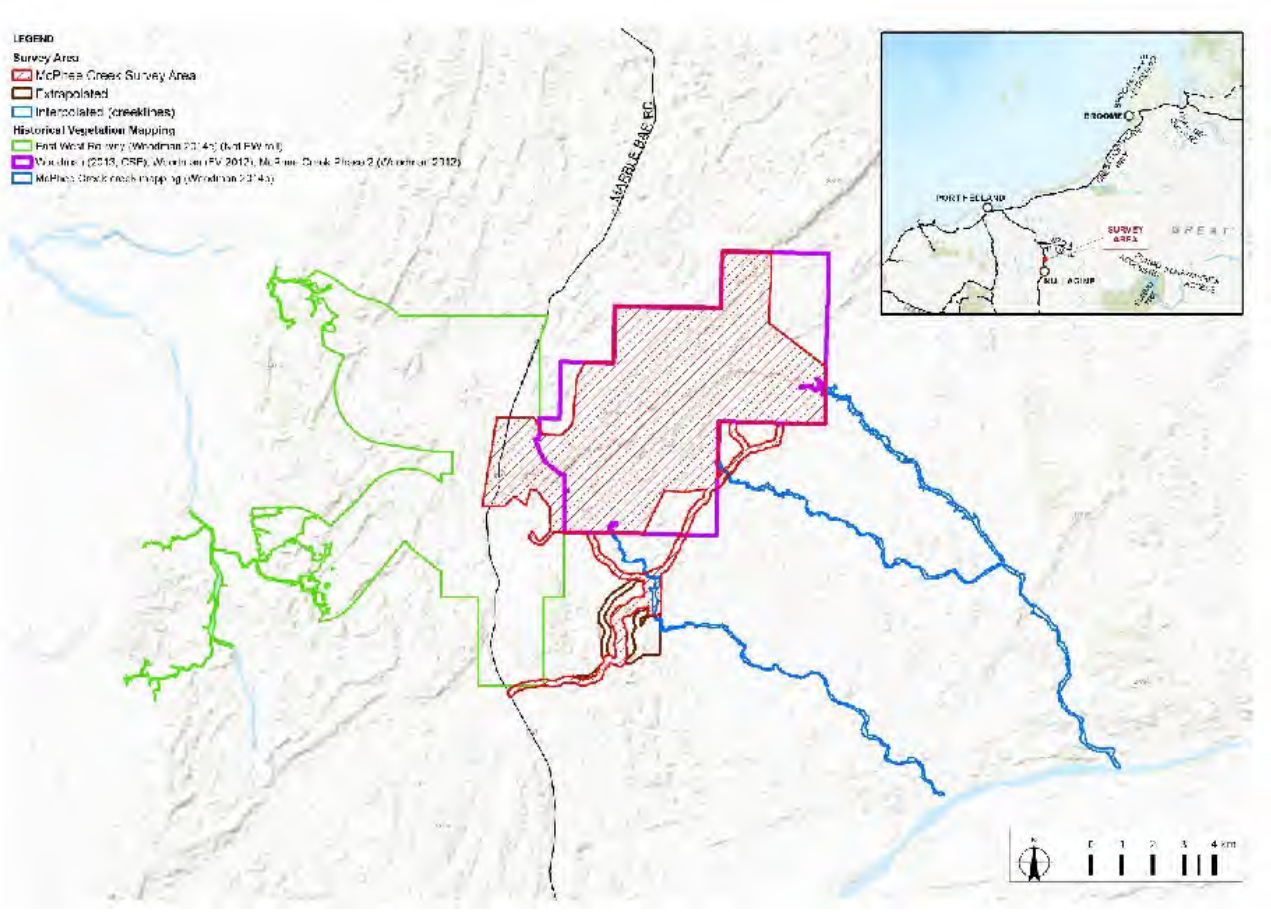


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to:

- collate and consolidate previous survey flora and vegetation data and mapping
- conduct a gap analysis and develop recommendations for field surveys that are required for ground truthing, resurveying or baseline purposes, or for targeted searches for conservation-listed flora and ecological communities
- field survey
- data management and reporting.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment Water Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999.*

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2016c) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known as the Flora and Vegetation Technical Guidance
- EPA (2016b) *Statement of Environmental Principles, Factors and Objectives*.

1.4.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

At a Commonwealth level, Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 17** in **Appendix One**).

1.4.2 WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.4.3 WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 18** in **Appendix One**; these categories align with those of the EPBC Act.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species.

The most recent listings were published in the *Government Gazette* on 11 September 2018 (Government of Western Australia 2018c).

1.4.4 FLORA

1.4.4.1 Threatened and Priority Flora

Conservation significant flora species, also known as conservation-listed species, are those that are listed as Threatened Flora (TF) and (within Western Australia) as Priority Flora (PF). TF species are listed as Threatened by the Western Australian DBCA and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act.

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are seven categories covering State-listed TF and PF species (DBCA 2019) which are outlined in **Table 18** in **Appendix One**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 18**.

1.4.4.2 Other Significant Flora

According to the *Flora and Vegetation Technical Guidance* (EPA 2016c) other than being listed as TF or PF, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.4.4.3 Introduced Flora

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on FloraBase (Western Australian Herbarium [WAH] 1998-2020) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Australian Government & Department of the Environment and Energy [DotEE] 2018; Weeds Australia 2012). The Commonwealth *National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance* (2012) describes broad goals and objectives to manage these species.

Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

1.4.5 ECOLOGICAL COMMUNITIES

1.4.5.1 EPBC-listed Threatened Ecological Communities

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (Government of Western Australia 2016). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. An ecological community may be categorised into one of the three sub-categories:

- Critically Endangered, if it is facing an extremely high risk of extinction in the wild in the immediate future
- Endangered, if it is not critically endangered and is facing a very high risk of extinction in the wild in the near future
- Vulnerable, if it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

1.4.5.2 Western Australian Threatened Ecological Communities

Western Australian TECs are protected under the BC Act. TECs are categorised much like those of the EPBC Act, shown in **Table 19** in **Appendix One**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

1.4.5.3 Western Australian Priority Ecological Communities

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 17 January 2019 (Species and Communities Program, DBCA 2019).

1.4.6 OTHER SIGNIFICANT VEGETATION

According to the *Flora and Vegetation Technical Guidance* (EPA 2016c), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

Groundwater Dependent Ecosystems, also known as Groundwater Dependent Vegetation, may be considered as significant vegetation due to all of the above features, and is described below.

1.4.6.1 Groundwater Dependent Ecosystems

Groundwater Definition

Groundwater is water that is found in the saturated zone of the soil, where all soil pores are filled with water. The water table is the upper surface of the saturated zone in an unconfined aquifer. Groundwater may also occur as a perched aquifer located above unsaturated rock formations as a result of a discontinuous permeable layer or held under pressure in a confined aquifer (Goulburn-Murray Water 2010).

Groundwater Dependent Ecosystems Definition

Groundwater Dependent Ecosystems (GDEs) have been defined as ecosystems that are dependent on groundwater for their survival at some stage or stages of their lifecycle, however groundwater use cannot be equated with groundwater dependence (Eamus 2009b). In some contexts, GDEs are also known as Groundwater Dependent Vegetation.

Hatton and Evans (1998) identified four types of GDEs based on their geographic setting: terrestrial vegetation (vegetation communities and dependent fauna that have seasonal or episodic dependence on groundwater), river base flow systems (aquatic and riparian ecosystems that exist in or adjacent to streams that are fed by groundwater base flow), aquifer and cave ecosystems, and wetlands.

Eamus *et al.* (2006) identified three primary classes based on type of groundwater reliance:

1. Aquifer and cave ecosystems.
2. All ecosystems dependent on the surface expression of groundwater:
    a) river base flows
    b) wetlands, swamplands
    c) seagrass beds in estuaries
    d) floodplains
    e) mound springs
    f) riparian vegetation
    g) saline discharge to lakes
    h) low lying forests.
3. All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the water table) when roots penetrate this zone:
    a) River Red Gum (*Eucalyptus camaldulensis*) forests
    b) Banksia woodlands
    c) Riparian vegetation in the wet/dry tropics.

GDEs in the Pilbara are generally determined to be vegetation associated with riparian areas. GDEs dependent on the surface expression of groundwater (Eamus *et al.* 2006 class 2) includes vegetation associated with wetlands (permanent or semi-permanent pools) within riparian areas, and generally includes *Melaleuca argentea* in association with other species described below. GDEs associated with the subsurface presence of groundwater (Eamus *et al.* 2006 class 3) includes riparian vegetation characterised by the phreatophytic species described below.

Direct impacts on GDEs i.e. clearing, and indirect impacts, including from dewatering and reinjection, frequently feature as being a significant environmental impact in mining approvals documents e.g. (Office of the Appeals Convenor 2016a; 2016b; Rio Tinto 2016).

Phreatophytic Species

Phreatophytic species rely on groundwater sources for water intake (Maunsell Australia Pty Ltd 2006); essentially the water requirements of phreatophytes are greater than can be provided from the surface soil profile (e.g. riparian vegetation) or they are dependent on free water availability (e.g. wetland species). They frequently show low tolerance to extended water stress due to a lack of physiological and/or morphological adaptation to drought, and respond to significant water deficit by a decline in health and eventual death (*ibid.*).

Obligate phreatophytes are dependent on free access to water (i.e. they are wetland species) whereas facultative phreatophytes can switch their water source between the soil surface profile in times of rain, to groundwater in times of drought when the soil surface profile (vadosphere) is depleted (Grierson 2010).

Phreatophytic species likely to occur in the Pilbara include:

- *Eucalyptus camaldulensis* subsp. *refulgens*, which is regarded as a facultative phreatophyte that is dependent on groundwater for part of its lifecycle and/or in times of drought. This species has been reported to be tolerant of groundwater falls of up to 4 m per year (Maunsell Australia Pty Ltd 2006), has both lateral and sinker roots and is tolerant of waterlogging (Grierson 2010).
- *Eucalyptus victrix*, which may be regarded as a facultative phreatophyte. It is considered to be relatively drought tolerant and likely to be tolerant of gradual declines to the water table (to a degree) (Maunsell Australia Pty Ltd 2006). *Eucalyptus victrix* has lateral and sinker roots (i.e. a dimorphic root system) but is not tolerant of waterlogging (Grierson 2010). There is some conjecture that this species is actually a vadophyte (i.e. relies on water from within the soil surface profile, and is independent of groundwater) or, at best, weakly phreatophytic (Resource and Environmental Management Pty Ltd 2007). Depth to groundwater is likely to be an important indicator of groundwater dependence (Equinox Environmental 2017).
- wetland species such as *Melaleuca argentea*
- *Melaleuca xerophila* may be groundwater dependent in some areas (Markey 2016).

Vegetation containing *Eucalyptus camaldulensis* subsp. *refulgens* and *Melaleuca argentea* is generally considered to represent a GDE. However, there is supporting evidence that, in some circumstances, *Eucalyptus victrix* does not always depend on groundwater (Batini 2009; Eamus 2009a; EPA & Hamersley Iron Pty Ltd 2010; Resource and Environmental Management Pty Ltd 2007) and therefore vegetation characterised by this species is considered to be potentially representative of a GDE.

Atlas of Groundwater Dependent Ecosystems

The Groundwater Dependent Ecosystems Atlas (Australian Government & Bureau of Meteorology [BoM] 2018) indicates the presence of known GDEs and Inflow Dependent Ecosystems (IDEs) in Australia.

An Inflow Dependent Ecosystem is one in which the vegetation within the landscape is likely to be accessing water in addition to rainfall, from soil or surface water or groundwater, assessed using remotely sensed data. The likelihood of a landscape using additional water is rated from one to 10 (low to high), with a rating above six indicating that a landscape is likely to be inflow dependent (Australian Government & BoM 2018).

Groundwater Dependent Vegetation

Groundwater Dependent Ecosystems, by definition, refers to biota and processes (i.e. ecosystems) that are dependent on groundwater. However, in the context of a flora and vegetation survey only the botanical aspect is under investigation. Therefore, within this report areas of GDE are referred to as Groundwater Dependent Vegetation (GDV).

1.4.7 ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas around Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the Environmental Protection (Environmentally Sensitive Areas) Notice (Government of Western Australia 2005).

1.4.8 CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018a).

2 DESKTOP ASSESSMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The survey area is located within the Pilbara region, which includes two broad climatic zones. Coastal areas, as well as some higher rainfall inland areas, have a semi-desert tropical climate which experience 9–11 months of dry weather, with hot humid summers and warm winters. The remaining inland areas have a dry desert climate, typically with higher temperatures and lower rainfall, and often experience up to 12 months of dry weather, with hot dry summers and mild winters (Leighton 2004). The survey area is within the dry inland area.

According to the Köppen-Geiger climate classification, the survey areas have a hot arid desert (Class BWh) (Peel *et al.* 2007). This classification is considered to represent a desert climate where annual rainfall is generally less than 200 mm or the region loses more water via evapotranspiration than it receives as rain, generally a result of hot, sunny weather without significant cloud. The mean average temperature exceeds 18°C, and summer temperatures are frequently over 40°C.

The closest Bureau of Meteorology (BoM) station with long term records is Marble Bar (station 4106, open since 2000; BoM 2020a, accessed May 2020) located approximately 60 km north northwest of the survey area. The mean annual rainfall is 392.7 mm falling mainly during the summer (December–March) period. The rainfall in the 4-month period preceding the survey in March was approximately 91% of the long-term mean for the December–March period.

December is the hottest month with a mean maximum temperature of 42° and minimum of 26.2°. July is the coldest month with a mean maximum of 27.5° and minimum of 12.2°.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year preceding the field survey.

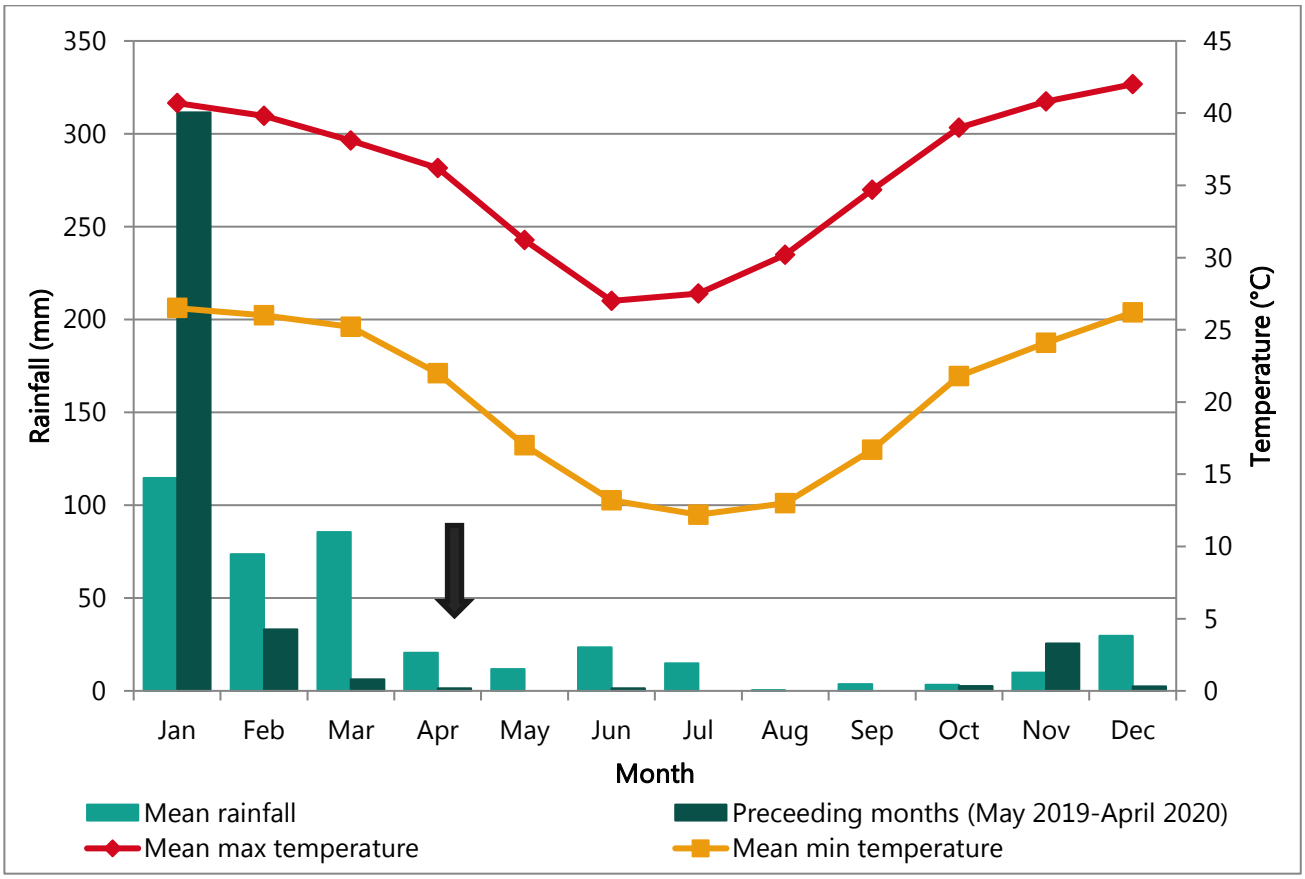


Figure 2: Rainfall and temperature data for the survey area (Marble Bar, 2000–2020, BoM 2020a); survey period indicated by arrow

2.1.2 LAND SYSTEMS

According to Department of Primary Industries and Rural Development (DPIRD 2018b) soil landscape mapping, the following land systems intersect the survey area (**Table 2** and **Map 1**).

Table 2: Land systems (DPIRD 2018b)

Mapping unit	Land System	Description	Extent (ha)	%
280Cp	Capricorn System	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	2,819.42	46.56
280Mo	Mosquito System	Stony plains and prominent ridges of schist and other metamorphic rocks supporting shrubby hard spinifex grasslands.	23.18	0.38
280Ri	River System	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	2.21	0.04
280Ro	Robe System	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.	255.46	4.22
280Rk	Rocklea System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,504.36	41.36
280Tl	Talga System	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	206.18	3.40
280Ty	Taylor System	Stony plains and isolated low hills of sedimentary rocks supporting hard and soft spinifex shrubby grasslands.	244.75	4.04

2.1.3 GEOLOGY

The survey area is located in the Pilbara region (Fortescue Botanical District) as defined by (Beard 1975; Beard 1990). The survey area is an exemplar of the region's topographic description, capturing a range of landforms including mountains (rising to 1,250 m), plains and shallow skeletal soils on ranges. The Pilbara region is formed of a basement of Archaean granite and volcanics, overlain by massive deposits of Proterozoic sediments and volcanics (Beard 1990). The regional geological setting of Nullagine falls within the West Pilbara Granite Greenstone Terrane (greenstones and granites) and the Central Pilbara Tectonic Zone (greenstones) (Bagus 2005).

At a 1:500,000 scale, the survey are is characterised by 13 geological units (**Map 2**, **Table 3**) defined within the State interpreted bedrock geology (Department of Mines Industry Regulation and Safety 2019).

Table 3: Geological units that intersect the survey area (Department of Mines Industry Regulation and Safety 2019)

GEOLCODE	Unit	Extent (ha)	%
A-DG-s	De Grey Supergroup: Siliciclastic sedimentary rocks; metamorphosed	298.54	4.93
A-FO-od	Mt Bruce Supergroup: Dolerite dyke or sill	116.86	1.93
A-GC-xca-b	De Grey Supergroup: Gorge Creek Group: Undivided; banded iron-formation and siliciclastic sedimentary rock; metamorphosed	20.50	0.34
A-GC-xci-s	De Grey Supergroup: Gorge Creek Group: Undivided; banded iron-formation and siliciclastic sedimentary rock; metamorphosed	1,549.42	25.59
A-FOh-xs-f	Mt Bruce Supergroup: Fortescue Group: Hardey Formation: sedimentary and felsic volcanic rocks; local intrusive rocks	276.41	4.56
A-od-PEP	Metadolerite in dykes and sills	204.23	3.37
A-og-PEP	Metagabbro in dykes and sills	2.09	0.03
A-NUq-mh	De Grey Supergroup: Nullagine Group: Mosquito Creek Formation: metamorphosed sandstone, siltstone, and shale; graded bedding and local cross-bedding; includes metamorphosed turbidite deposits	49.77	0.82
A-FOr-b	Mt Bruce Supergroup: Fortescue Group: Mount Roe Basalt: basaltic volcanic rocks; local volcaniclastic and siliciclastic rocks	319.93	5.28
A-WAp-xf-cc	Pilbara Supergroup: Warrawoona Group: Panorama Formation: felsic volcanic rock; local sedimentary rock; metamorphosed	5.04	0.08
A-WAp-f	Pilbara Supergroup: Warrawoona Group: Panorama Formation: felsic volcanic rock; local sedimentary rock; metamorphosed	1,045.41	17.26
A-WA-xb-f	Pilbara Supergroup: Warrawoona Group: mafic, ultramafic, and felsic volcanic and intrusive rocks, and sedimentary rocks; metamorphosed	2,167.24	35.79
A-KEw-xf-s	Pilbara Supergroup: Kelly Group: Wyman Formation: felsic volcanic and volcaniclastic rocks; local clastic sedimentary rocks, chert and basalt; metamorphosed	0.12	0.002
TOTAL		6055.55	100

2.1.4 WETLANDS AND DRAINAGE

The survey area is on the divide and has parts in both the Coongan River and Nullagine River catchments (DBCA 2007-2020). The Coongan River catchment drains towards the north to northeast. The Nullagine catchment drains, within the survey area, in a general southeast direction towards the Nullagine River, which is a tributary of De Grey River that enters the ocean approximately 70 km east northeast of Port Hedland. The survey area is within the De Grey Surface Water Management Area.

No significant riparian areas occur within the survey area, although there are three tributaries of Nullagine River within the survey area, including McPhee Creek.

No wetlands occur within the survey area.

2.1.5 GROUND WATER DEPENDENT ECOSYSTEMS

The *Groundwater Dependent Ecosystems Atlas* (Australian Government & BoM 2020) includes areas mapped as being low and moderate potential terrestrial GDE (national assessment) and contains small pools mapped as being unclassified potential aquatic GDE (regional study).

The survey area is considered as low potential for terrestrial GDEs to occur, with an IDE likelihood of mostly 7 indicating the landscape is likely to be inflow dependent.

2.1.6 ENVIRONMENTALLY SENSITIVE AREAS

No ESAs occur within or are located near the survey area. The nearest ESA is approximately 100 km to the south.

2.1.7 CONSERVATION LANDS

The survey area does not include any conservation lands. The nearest lands vested for conservation are over 100 km distant, although the survey area is approximately 11.5 km south of unallocated crown land of conservation interest to the DBCA (ex-Meentheena Station).

2.1.8 LAND USE HISTORY

The southern part of the survey area is located on Bonney Downs pastoral station and is grazed by cattle. The remaining areas are on unallocated crown land.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (DotEE 2016).

The survey area is located in the Pilbara IBRA region in the Chichester subregion (PIL1), described as (Kendrick & McKenzie 2002):

> *The Chichester subregion (PIL 1) comprises the northern section of the Pilbara Craton. Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised by Acacia inaequilatera over Triodia wiseana (formerly Triodia pungens) hummock grasslands, while Eucalyptus leucophloia tree steppes occur on ranges. The climate is Semi-desert-tropical and receives 300 mm of rainfall annually. Drainage occurs to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock). Subregional area is 9,044,560ha.*

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement, and is known as the pre-European vegetation type and extent and has since been developed in digital form by Shepherd *et al.* (2002) and updated by DPIRD (2018a). Extents are updated annually by DBCA (Government of Western Australia 2019). This mapping indicates that the survey area corresponds with two pre-European vegetation units:

- Association 171: Hummock grasslands, low tree steppe; snappy gum over soft spinifex & *Triodia brizoides*
- Association 173: Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt
- Association 190: Hummock grasslands, sparse shrub steppe; *Acacia bivenosa* & *A. trachycarpa* over hard spinifex, *Triodia wiseana*, Very poor rocky country on gneiss.

The pre-European vegetation associations identified from the survey area (DPIRD 2018a) and their pre-European and current extents are listed in **Table 4** (Government of Western Australia 2019) and shown on **Map 3**.

Table 4: Pre-European vegetation association representation (Government of Western Australia 2019)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% Remaining
Western Australia	171	331,951.73	330,643.09	99.61
	173	1,753,104.09	1,748,260.83	99.72
	190	169,199.72	169,051.00	99.91
IBRA biographic region (Pilbara)	171	331,307.41	330,026.24	99.61
	173	1,752,520.89	1,747,677.63	99.72
	190	169,199.72	169,051.00	99.91
IBRA biographic sub-region (Chichester)	171	331,307.41	330,026.24	99.61
	173	1,744,029.51	1,739,189.58	99.72
	190	169,199.72	169,051.00	99.91
LGA (Shire of East Pilbara)	171	331,951.73	330,643.09	99.61
	173	1,085,704.89	1,081,937.46	99.65
	190	169,199.72	169,051.00	99.91

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The *Protected Matters Search Tool* (PMST) search (Australian Government & Department of Agriculture Water and the Environment 2020, search reference PMST_Y522MC) using a 30 km buffer around an approximation of the survey areas (excluding riparian areas), identified no EPBC-listed TECs or suitable habitat for such occur or are likely to occur within the search area buffers.

The DBCA database search (search reference Nullagine_Ecoscape_TecPEcSearchResults_25022020 using a 40 km buffer) identified no known TECs and two PECs within the search area:

- Priority 3 *Mosquito Land System* PEC: Stony saline clay plains of the Mosquito Land System, four occurrences. This PEC, abbreviated to 'Mosquito PEC', is described (Species and Communities Program, DBCA 2020) as:

  Triodia longiceps perennial grasslands with scattered Maireana melanocoma and Sclerolaena spp. and includes Priority flora taxa Atriplex spinulosa (P1) and Ptilotus wilsonii (P1) dissected by drainage lines. Dominated by (but not limited to) Melaleuca eleuterostachya and Acacia bivenosa occurring on saline red brown non-cracking clays with a mantle of quartz gravel and neutral subsurface soil material on level to undulating plains. Largely restricted to an area east of Nullagine.

- Priority 1 *Wona Land System* PEC: Four plant assemblages of the Wona Land System (previously Cracking clays of the Chichester and Mungaroona Range), 11 occurrences. This PEC, abbreviated to 'Wona PEC', is described (Species and Communities Program, DBCA 2020) as:

  Cracking clays of the Chichester and Mungaroona Range. This grassless plain of stony gibber community occurs on the tablelands with very little vegetative cover during the dry season, however during the wet a suite of ephemerals/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa. Annual Sorghum grasslands on self mulching clays with a moderate-dense overlay of rocks. This community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range. Naturally species poor when dry. Mitchell grass plains (Astrebla spp.) on gilgai. Mitchell grass and Roebourne Plain grass (Eragrostis xerophila) plain on gilgai. Astrebla pectinata, A. elymoides, E. xerophila, Aristida latifolia, Eriachne and Sida fibulifera. Typical type, heavily grazed.

The creekline portions of the survey area adjacent to Nullagine River (i.e. the most southern and south-eastern parts) occupying 23.18 ha (0.38% of the survey area) intersect the Mosquito Land System (see **Table 2** and **Map 4**). Therefore, by definition, this portion of the survey area is considered representative of the *Mosquito Land System* PEC.

The Wona Land System does not intersect with the survey area.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified no EPBC-listed TF that are known to occur within the 30 km search buffer area.

A search of DBCA's databases was conducted (search reference 23-0220FL) using a 20 km buffer around the supplied shapefiles (TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium).

The DBCA database searches identified no TF and 28 PF have been recorded from within the search buffer:

- P1 (11 taxa): *Acacia aphanoclada*, *Acacia cyperophylla* var. *omearana*, *Acacia fecunda*, *Acacia* sp. Marble Bar (J.G. & M.H. Simmons 3499), *Acacia* sp. Nullagine (B.R. Maslin 4955), *Atriplex spinulosa*, *Cochlospermum macnamarae*, *Fimbristylis* sp. Shay Gap (K.R. Newbey 10293), *Ptilotus wilsonii*, *Solanum* sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795), *Stemodia* sp. Battle Hill (A.L. Payne 1006)
- P2 (one taxon): *Indigofera ixocarpa*
- P3 (10 taxa): *Acacia levata*, *Eragrostis crateriformis*, *Eucalyptus rowleyi*, *Heliotropium murinum*, *Heliotropium muticum*, *Nicotiana umbratica*, *Rostellularia adscendens* var. *latifolia*, *Swainsona thompsoniana*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Triodia basitricha*
- P4 (four taxa): *Bulbostylis burbidgeae*, *Goodenia nuda*, *Lepidium catapycnon*, *Ptilotus mollis*.

The combined database searches results are also included in **Table 23** in **Appendix Two**.

Atlas Iron maintains a database of conservation listed flora and other flora of conservation interest associated with its operational and exploration tenements. This database consists of DBCA database search results requested for flora and vegetation assessments and the results of field surveys it has commissioned. The resultant list, and associated location data, provides a comprehensive understanding of the conservation listed flora and other flora of conservation interest (e.g. significant range extensions, unusual forms) within and close to Atlas Iron's areas of interest. The results from Atlas Iron's database did not identify any additional TF or PF within the search area or survey area boundaries. These results are consistent with previous surveys (see **Figure 1**) conducted by Woodman (2012; 2014b; 2014c; 2019a). Woodman's surveys detected *Acacia aphanoclada*, *Eragrostis crateriformis*, *Fimbristylis* sp. Shay Gap (K.R. Newbey 10293), *Goodenia nuda*, *Ptilotus mollis*, *Rostellularia adscendens* var. *latifolia* and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431).

2.2.4.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify TF and PF species that have the potential to occur within the survey area. The likelihood of a species occurring is based on the following attributes, as listed on *FloraBase* (WAH 1998-2020; 2020) or *World Wide Wattle* (WAH 2019) and tailored to local populations, and information from recent nearby surveys, incorporating an assessment of habitats likely to be present in the survey area. The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is generally associated
- species having been recorded from within approximately 20 km of the survey area (considered as 'nearby') taking age of the record and locational accuracy into account
- nearby recent records (i.e. records within the previous 25 years).

The likelihood rating is assigned using the categories listed in **Table 5**.

Table 5: Categories for the likelihood of occurrence of TF and PF

Likelihood	Categories
Recorded	Species recorded within the survey area
Possible	May occur within the survey area (but has not been recorded); broadly, 2-4 of the required attributes (but always including records from nearby) are present in the survey area
Unlikely	Could occur but is not expected; 1-3 of the required attributes are present in the survey area but: • it is not known from nearby, or • it is known from nearby but has no other required attributes, or • it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area) • it is known from nearby, but the record is old (>25 years), or the locational data is potentially inaccurate, or the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area.
Highly unlikely	The species characteristics include only one, or none of the required attributes of soil, landform, associated vegetation and have been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.

The likelihood assessment is available in **Table 23** in **Appendix Two**.

Combined, all databases (DBCA and Atlas Iron) identified the following five PF as occurring within the survey area boundary: *Acacia aphanoclada* (P1), *Eragrostis crateriformis* (P3), *Goodenia nuda* (P4), *Ptilotus mollis* (P4) and *Rostellularia adscendens* var. *latifolia* (P3). These were prioritised for the survey, including ground truthing previous records and additional searches in areas considered likely to have a suitable habitat that had not been adequately surveyed in the past, including areas without any previous surveys.

No additional species were considered to have a high desktop likelihood of occurring within the survey area based on the expected habitat within the survey area.

Following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into **Table 23** and discussed further in **Section 4.1.3.2**.

2.3 LITERATURE REVIEW

2.3.1 PREVIOUS SURVEYS

Several flora and vegetation surveys have been conducted for Atlas Iron in areas corresponding with the current survey area and associated infrastructure corridors (see **Figure 1**). The significant findings identified as a result of the works are summarised as follows:

- Woodman (2019b) *Memo of gap analysis of flora and vegetation works undertaken to date at McPhee Creek mining project area with reference to current standards as per the Technical Guidance (EPA)*, included as **Appendix Eight**
  - identified need for additional: database searches, flora surveys, statistical analysis for enhanced regional context and impact assessment of the current disturbance areas and layout.
- Woodman (2019c) *Memo of potential impacts to vegetation types or significant taxa and determination of additional survey requirements at McPhee Creek mining project area*:
  - identified high–moderate local impacts on vegetation types (5, 6a, 6b, 8a and 8b) within the survey area.

  - ranked low regional scale impacts to all conservation-listed flora (*Acacia aphanoclada, Eragrostis crateriformis, Ptilotus mollis* and *Rostellularia adscendens* var. *latifolia*) within the survey area.
  - barring *Acacia aphanoclada* (high) all other conservation-listed flora were ranked as low local scale impacts.
- Woodman (2019a) *McPhee Creek Iron Ore Project Detailed Flora and Vegetation Impact Assessment*[1], included as **Appendix Seven**
- Woodman (2014a) *McPhee Creek Iron Ore Project Flora and Vegetation Impact Assessment*
  - documents the potential impacts of the proposed development (pits, waste dumps, tailings, processing, infrastructure, hydrological change) on significant flora and vegetation
  - three conservation-listed flora may be directly impacted by the development (*Acacia aphanoclada*, P1; *Eragrostis crateriformis*, P3; *Ptilotus mollis*, P4) with the local impact to each being variable but potentially High, and regional impact likely to be low for *Acacia aphanoclada* and *Ptilotus mollis*, but potentially Moderate-High for *Eragrostis crateriformis*
  - *Rostellularia adscendens* subsp. *latifolia* (P3) may be indirectly impacted by discharge water, however, likely impacts were not assessed as being significant
  - the level and significance of impacts on vegetation could not be quantified due to lack of regional data, however, it was noted that no vegetation was representative of a TEC or PEC
  - some riparian vegetation is likely to be indirectly impacted by altered hydrology, however, impacts were unlikely to be prolonged
- Woodman (2014b) *McPhee Creek Iron Ore Project Riparian Vegetation Mapping (Discharge options 1, 2 and 3)*[1]
- Woodman (2014c) *McPhee Creek Rail Project (Eastern Corridor Yandeyarra to Mt Webber and McPhee Creek) Flora and Vegetation Assessment - Post Wet Season 2013*[1]
- Woodman (2014d) *McPhee Creek Rail Spur Project Flora and Vegetation Assessment*[1]
- Woodman (2013) *McPhee Creek Iron Ore Project Conservation Significant Flora Assessment*[1]
- Woodman (2012) *McPhee Creek Project Flora and Vegetation Assessment*[1]
- Woodman (2011) *McPhee Creek Project Flora and Vegetation Desktop Review*.

[1] Reports containing primary survey (i.e., primary surveys result from field surveys while tertiary surveys resulting from desktops/literature reviews) data are presented in **Table 6**.

Table 6: Literature review of primary surveys in proximity to/overlapping the survey area

Reference	Survey name	Survey components	Flora taxa	Vegetation-types, - condition and conservation status	Conservation listed- and introduced-taxa
Woodman (2019a): see Appendix Seven	McPhee Creek Iron Ore Project Detailed Flora and Vegetation Impact Assessment	Desktop based on three historical detailed vegetation surveys: Woodman (2013) Woodman (2011) Woodman (2012)	Families: 51 Genera: 165 Taxa: 388	Vegetation types: 19 Vegetation condition: 'Excellent' to 'Very Poor' Conservation status: no PECs/TECs	Conservation taxa: 4–*Acacia aphanoclada* (P1), *Eragrostis crateriformis* (P3), *Ptilotus mollis* (P4), and *Rostellularia adscendens* var. *latifolia* (P3) Introduced taxa: 15–including one declared pest (*Argemone ochroleuca*)
Woodman (2014b): see Appendix Eight	McPhee Creek Iron Ore Project Riparian Vegetation Mapping (Discharge options 1, 2 and 3)	Single phase Level 2 flora and vegetation survey 39 quadrats	Families: 38 Genera: 105 Taxa: 165	Vegetation types: 3 Vegetation condition: 'Very Poor' to 'Very Good'. Conservation status: no PECs/TECs	Conservation taxa: 1–*Rostellularia adscendens* var. *latifolia* (P3) Introduced taxa: 12–including one declared pest (*Argemone ochroleuca*)
Woodman (2014c)	McPhee Creek Rail Project (Eastern Corridor Yandeyarra to Mt Webber and McPhee Creek) Flora and Vegetation Assessment - Post Wet Season 2013	Single Level 2 flora and vegetation survey 302 non-permanent plots	Families: 62 Genera: 193 Taxa: 508	Vegetation types: 19 following manual fusion of three outlying plots belonging to two broad groups Vegetation condition: 'Excellent' Conservation status: no PECs/TECs	Conservation taxa: 13–*Acacia cyperophylla* var. *omearana* (P1), *Acacia levata* (P3), *Acacia* sp. indet (potentially undescribed), *Acacia* sp. Nullagine (B.R. Maslin 4955) (P1), *Bulbostylis burbidgeae* (P4), *Cochlospermum macnamarae* (P1), *Eragrostis crateriformis* (P3), *Goodenia nuda* (P4), *Gymnanthera cunninghamii* (P3), *Heliotropium murinum* (P3), *Nicotiana umbratica* (P3), *Phyllanthus hebecarpus* (P3), *Ptilotus mollis* (P4) ; and *Rothia indica* subsp. *australis* (P1). Introduced taxa: 19–including one declared pest ()
Woodman (2014d)	McPhee Creek Rail Spur Project Flora and Vegetation Assessment:	Two phase Level 2 flora and vegetation survey 188 non-permanent plots	Families: 54 Genera: 159 Taxa: 364	4 broad groups and 23 No PECs/TECs Vegetation condition ranged from 'Very Good' to 'Poor'	Conservation taxa: 10–*Cochlospermum macnamarae* (P1), *Rothia indica* subsp. *australis* (P1), *Eragrostis crateriformis* (P3), *Gymnanthera cunninghamii* (P3), *Heliotropium murinum* (P3), *Nicotiana umbratica* (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Bulbostylis burbidgeae* (P4), *Rhynchosia bungarensis* (P4) and *Abutilon* aff. *hannii* (potentially undescribed). Introduced taxa: 11–including one declared pest/ WoN (*Parkinsonia aculeata*)

Reference	Survey name	Survey components	Flora taxa	Vegetation-types, - condition and conservation status	Conservation listed- and introduced-taxa
Woodman (2013)	McPhee Creek Iron Ore Project Conservation Significant Flora Assessment	Targeted flora survey	Not applicable	Not applicable	Conservation taxa: 4–*Eragrostis crateriformis* (P3), *Ptilotus mollis* (P4) and *Rostellularia adscendens* var. *latifolia* (P3)
Woodman (2012)	McPhee Creek Project Flora and Vegetation Assessment:	Two phase Level 2 flora and vegetation survey 125 quadrats	47 families 141 genera 309 taxa Families: 47 Genera: 141 Taxa: 309	Vegetation types: 12 belonging to two broad groups Vegetation condition: 'Excellent' Conservation status: no PECs/TECs; vegetation type 3b delineated as facultative phreatophytic vegetation	Conservation taxa: 3–*Acacia aphanoclada* (P1), *Eragrostis crateriformis* (P3) and *Ptilotus mollis* (P4) Introduced taxa: 8–including highly invasive **Cenchrus ciliaris*, **C. setiger* and **Aerva javanica*.

2.3.2 OTHER NEARBY SURVEYS

Other areas located within the same IBRA subregion have been subject to flora and vegetation surveys. Some of the more significant findings are summarised below.

Hazelwood Resources Cookes Creek Tungsten Project area, located approximately 20 km east of the survey area:

- Ecoscape (2011) *Cookes Creek - Level 2 Flora and Vegetation Survey*, detailed the findings of a Level 2 (now Detailed) survey of the combined earlier survey area (adding a second phase) and a number of previously inaccessible parts of the tenement and additional areas of interest. The significant findings were three Priority-listed flora species, one range extension and one range edge flora species, and vegetation on the relevant land system potentially representative of the Mosquito PEC.
- Ecoscape (2009) *Cookes Creek Vegetation and Flora Assessment*, identified 161 flora species (three Priority-listed) and five vegetation types, none of significance.
- Ecologia Environment (2007) *Cookes Creek Tungsten Project: Level 1 Vegetation and Flora Survey*, identified 82 vascular flora species, none conservation-listed, and five vegetation types, none considered significant.

Millennium Minerals project areas, located approximately 25 km south of the survey area:

- Mattiske Consulting (2010a) *Assessment of flora and vegetation on the Airstrip Expansion Area*, during which 15 vascular flora and two plant communities were recorded, none of significance.
- Mattiske Consulting (2010b) *Assessment of flora and vegetation on the All Nations Lease Area*, identified 61 vascular flora species and five plant communities, none of significance.
- Mattiske Consulting (2010c) *Assessment of flora and vegetation on the Barton Lease Area*, identified 61 vascular flora species and five plant communities, none of significance, although it was noted that two Priority-listed species had been previously recorded within the survey area or wider lease area.
- Mattiske Consulting (2010d) *Assessment of flora and vegetation on the Golden Gate and associated Lease Areas*, identified 105 vascular flora species and three plant communities, none of significance.
- Mattiske Consulting (2010e) *Assessment of flora and vegetation on the Little Wonder Lease Area*, identified 20 vascular flora species and three plant communities, none of significance.
- Mattiske Consulting (2010f) *Assessment of flora and vegetation on the Otways Lease Area*, identified 20 vascular flora species and four plant communities, none of significance.
- Mattiske Consulting (2010g) *Assessment of flora and vegetation on the Shearers Lease Area*, identified 89 vascular flora species including one Priority-listed species (*Acacia aphanoclada*) and four plant communities, none of significance.
- Mattiske Consulting (2010h) *Flora and Vegetation of the Nullagine Project Areas*; this report updates on previous surveys and summarises results. The combined surveys have identified 259 taxa including one TF (now P4, *Lepidium catapycnon*) and two other Priority-listed species (and another potential PF), and no significant vegetation.

Atlas Iron's Corunna Downs Iron Ore Project area, located approximately 40 km northwest of the survey area:

- Woodman (2017) *Corunna Downs Intersection Works Flora and Vegetation Assessment*, details the survey results of three separate areas. No conservation-listed flora or vegetation was recorded.
- Woodman (2016) *Corunna Downs Project Level 2 Flora and Vegetation Assessment*, identified 413 vascular flora taxa including 11 Priority-listed taxa three potentially undescribed taxa and two disjunct taxa, and 15 vegetation types, none of which were conservation-listed although two were considered as potentially groundwater dependent due to the presence of *Eucalyptus camaldulensis* and *Melaleuca argentea*.

BC Iron Nullagine Project, located approximately 45 km south of the survey area:

- Astron Environmental Services (Astron 2009) *Nullagine Project flora and vegetation survey May-September 2008*, identified: 462 vascular flora species including eight Priority Flora and 59 vegetation types including one from the Wona PEC and a number located on Robe Pisolite that were considered significant.

Roy Hill Mine and vicinity, located approximately 60 km south:

- Botanic Gardens and Parks Authority (2017) *Population survey for Triodia veniciae in the East Pilbara, June 2017*, detailing the results of a survey for this (now P3-liisted) species that identified it as occurring across a 140 km range in shale substrate.

Atlas Iron Abydos area, located approximately 100 km northwest:

- Coffey Environments (2014b) *Significant Species Management Plan Abydos DSO Project*, detailing management objectives and requirements for significant species six conservation-listed flora species (one now TF), weeds and vegetation, although no recorded vegetation types were representatives of conservation-listed ecological communities.
- Woodman (2013) *Abydos Direct Shipping Ore Project Stage 2 Flora and Vegetation Impact Assessment*, identified a gorge with groundwater dependent tree species (*Melaleuca argentea* and *Eucalyptus camaldulensis*) as being significant but did not identify a specific vegetation unit within it.

Fortescue Metals Group North Star project area, located approximately 120 km west northwest of the survey area:

- Ecoscape (2018) *Glacier Valley Extension Flora and Vegetation Survey, North Star Project*, described a two phase detailed flora and vegetation survey that recorded 218 vascular flora species including three conservation-listed species (one TF) and one Declared Pest plant not previously recorded from the area, and 11 vegetation types, three of which were considered significant including one potential GDE and two with only small extents (<1% of the survey area).
- Ecologia Environment (2015a) *North Star Aerodrome Flora Level 2 and Fauna Level 1 Assessment*, details the survey results of a 6,230 ha area during which no significant flora or vegetation were recorded.
- Ecologia Environment (2015b) *North Star Slurry and Infrastructure Corridors Conservation Significant Flora and Vegetation Assessment*, identified 12 pl-flora species and three vegetation types (characterised by *Eucalyptus camaldulensis* and *Melaleuca argentea*) that were considered significant as they represented GDEs.
- Coffey Environments (2014a) *North Star Alternate Access Road Flora and Vegetation Assessment*, identified 116 flora species including two Priority-listed species and 10 vegetation types, none of which were considered to be significant.
- Ecologia Environment (2012a) *North Star Access Corridor Flora, Vegetation, Vertebrate Fauna and Fauna Habitat Assessment*, identified 163 vascular flora species, one Priority-listed and one a significant range extension, and nine vegetation types, one considered as significant as habitat for the species with a significant range extension and one GDE.
- Ecologia Environment (2012b) *North Star Vegetation and Flora Assessment*, identified 472 vascular flora species including eight Priority-listed species (one of which is now TF-listed) and a number of vegetation types considered as significant including:
  - four vegetation units that correlated with the now TF-listed species (*Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp4)) that meet the requirements to be significant as a key habitat for threatened species
  - two vegetation types that were poorly represented and restricted to particular habitats

- Ecologia Environment (2012c) *Pityrodia* sp. *Marble Bar Targeted Flora Survey* details the findings of a targeted survey for this species.

2.4 VEGETATION TYPE CONSOLIDATION

Woodman had previously conducted a significant amount of flora and vegetation survey within, adjacent and near to the McPhee Creek survey area, as detailed in **Section 2.3.1** above. However, Woodman mapped the vegetation at a level similar to National Vegetation Information System (NVIS) Level VI (NVIS Technical Working Group 2017) whereas the current recommendation for vegetation survey in Western Australia is generally considered to be NVIS Level V (EPA 2016c), which is a lower level of detail. NVIS Level V vegetation descriptions incorporate up to three dominant and characteristic species from up to three strata, with the order that species are listed being the order of dominance within the stratum. Woodman descriptions listed multiple species from each strata present, apparently in alphabetical order and for some with density information for each species rather than stratum, and provided a complicated description incorporating species with very low cover values or significance within the vegetation. An example of a Woodman vegetation type description simplified and converted to NVIS Level V is provided in **Table 7**.

Table 7: Example comparison of Woodman vegetation type description and conversion to NVIS Level V description

Woodman Vegetation Type Description (from Woodman 2019a)	Preliminary Consolidated Ecoscape Description
Low Isolated Trees to Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Clumps of Shrubs to Tall Sparse Shrubland of *Acacia monticola* over Low to Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* (occasionally with *A. synchronicia*, *Corchorus parviflorus*, *Ptilotus obovatus*, *Senna glutinosa* subsp. *glutinosa*, *Senna symonii* and/or *Tribulus suberosus*) over Low Hummock Grassland of *Triodia brizoides* (occasionally *T. wiseana*) and Low Isolated Clumps of Tussock Grasses to Mid Open Tussock Grassland of *Cymbopogon ambiguus* and *Eriachne mucronata* on brown to red-brown clay loam, with granite outcropping on very steep upper slopes on hills adjacent to the main range	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia bivenosa*, *A. monticola* and *A. synchronicia* mid open shrubland over *Triodia brizoides* and *T. wiseana* low hummock grassland

The greater level of detail recorded by Woodman contributed to the issues identified during the gap analysis, particularly disparity in the vegetation mapping, and provided an overly complicated description of the vegetation present.

Ecoscape consolidated and simplified the vegetation type descriptions by identifying the dominant species and strata within the Woodman description and converting these to plain English versions of the NVIS code descriptions. Where simplified vegetation types were appreciably similar, the aerial image signature and Ecoscape experience was used to confirm if they were likely to be similar and could be merged, or if they required ground truthing during the field survey (see **Section 2.5.1.3** below).

The consolidated, simplified vegetation types were used during the gap analysis detailed below.

2.5 GAP ANALYSIS

A gap analysis was conducted before conducting any field surveys. The analysis focused mostly on data collation and consolidation between three overlapping studies (Woodman 2012; Woodman 2014b; Woodman 2014c).

The results of the gap analysis identified several locations within the survey area that required:

- ground-truthing, including the rectification of misalignments due to being adjoining areas of different surveys or where the NVIS Level VI vegetation types could not be subsumed into Level V types
- resurveying, including where there were insufficient quadrats within the survey area to align with the requirements of a detailed survey according to the EPA (2016c) Flora and Vegetation Technical Guidance (noting that sufficient quadrats had been recorded during previous surveys, however, many representatives were outside the current survey area)
- locating quadrats in areas of apparent spatial gaps
- survey for baseline purposes, i.e. previously unsurveyed areas
- targeted searches for conservation-listed flora and ecological communities
- ground truthing of some riparian areas to confirm groundwater dependence status.

The results of the gap analysis, and resultant recommendations for field survey, were discussed with Atlas Iron before commencing the field survey.

The following activities were undertaken as part of the gap analysis.

2.5.1 DATA COLLATION AND CONSOLIDATION

Ecoscape conducted a preliminary visual inspection of the vegetation mapping studies (Woodman 2012, McPhee Creek; Woodman 2014b, riparian vegetation mapping; Woodman 2014c, rail project) intersecting through the Esri ArcGIS platform. The inspection demonstrated:

1. Topological errors within Woodman's (2012) mapping e.g. mapping of creek line vegetation types should follow creek lines, however, several of the vegetation types were found askew to creek lines.
2. Spatial overlap between all survey areas.
3. Several vegetation types from one series of vegetation mapping did not match the vegetation types of the adjacent map.
4. Vegetation types were not extended between adjacent mapping studies.

2.5.1.1 Topological Errors

A preliminary inspection identified topological errors (e.g. mapping of creek line vegetation types, as above) within the Phase 2 Vegetation Mapping (Woodman 2014c) layer. The topological errors were fixed by manually moving the mapping 30 m west and 10 m south followed by systematic checks that of all vegetation types corresponded to visual signatures in the aerial imagery and that their descriptions matched nearby quadrat data.

This movement resulted in small gaps on the eastern and northern boundaries of the survey area; these gaps were filled by expanding the current vegetation to the perimeter of the survey area using high-quality aerial imagery (provided by Atlas Iron, 10 m resolution) after confirming that there were no major vegetation type changes within the extrapolated area.

2.5.1.2 Spatial Overlap Between the Historical Survey Areas

Spatial overlap between the vegetation mapping was minor. The most significant areas of overlap occurred between Woodman's (2012) and (2014c) vegetation mapping. We used ArcGIS to remove the vegetation types from the E-W mapping (2012) that were overlapping the Phase 2 (2014c) vegetation. Likewise, the small areas of the Woodman (2014b) overlapping the Woodman (2014c) vegetation was trimmed.

The merging of the non-overlapping vegetation layers formed an interim vegetation mapping layer that was groundtruthed during the field survey.

2.5.1.3 The Mismatch Between Adjacent Vegetation Types

Merging vegetation maps produces 'artefacts'. For example, discrete vegetation patches form along the adjacent edges where two vegetation maps intersect.

To overcome this, Ecoscape sought to confirm if the vegetation types had continuity by visualising the underlying signature presented in the spectral imagery provided by Atlas Iron (10 m resolution), and checked if the neighbouring polygons shared the same NVIS description. Ecoscape used the NVIS Level VI vegetation type descriptions converted into Level V types to both improve commensurability between the mapping units and align with the requirements of a detailed survey according to the EPA (2016c) Flora and Vegetation Technical Guidance.

2.5.1.4 Riparian Area/Groundwater Dependence Confirmation

Previous mapping of the McPhee Creek area by Woodman (see **Section 2.3.1** above for list of references) had identified a number of areas described as being representative of GDVs). Woodman used hydrological information to inform its assessment as well as identifying vegetation with phreatophytic species. However, Woodman's field surveys also incorporated a larger extent than Ecoscape groundtruthed in 2020.

Woodman (2019a) identified 19 vegetation types characterised by phreatophytic species, however, taking into consideration hydrological information and physiological characteristics of the phreatophytic species, only one was considered likely to represent a GDV, although only in localised areas, and three potentially representative, also only in localised areas (**Table 8**).

Woodman based its considerations of groundwater dependence on the following physiological traits:

- *Eucalyptus camaldulensis* was considered an obligate or facultative phreatophyte depending on the hydrological characteristics of the site
- *Eucalyptus victrix* was considered a presumed facultative phreatophyte although in most cases is likely to be a vadophyte
- *Acacia ampliceps* was considered a presumed facultative phreatophyte
- *Atalaya hemiglauca* was considered a presumed facultative phreatophyte
- *Melaleuca glomerata* was considered a presumed facultative phreatophyte
- *Sesbania cannabina* was considered a presumed facultative phreatophyte but potentially an obligate phreatophyte.

Table 8: Woodman (2019a) Groundwater Dependent Ecosystems

Woodman Vegetation Type (removing grassy ground strata)	GDV	Woodman Comment (quote)
15: Mid Isolated Clumps of Trees to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Mid to Tall Isolated Clumps of Shrubs to Mid to Tall Open Shrubland *of Acacia pyrifolia* subsp. *pyrifolia*, *A. trachycarpa* and *Atalaya hemiglauca* over Low Isolated Clumps of Shrubs of *Pluchea tetranthera*, *Sesbania cannabina* and *Stemodia grossa* on brown sand, sandy loam and sandy clay in drainage lines associated with granite outcropping.	'likely'	There is a potential for GDV to occur through a combination of phreatophytic taxa and depth to groundwater being generally <10m from surface; however, this may be localised patches only, as sampled by areas where denser layers of taxa such as *Melaleuca glomerata*, or combinations of *E. camaldulensis*, *M. glomerata* and *S. cannabina* occur. This VT was associated an underlying granite substrate.
14: Description: Mid Open Woodland to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Tall Sparse Shrubland to Tall Open Shrubland of *Acacia ampliceps*, *A. coriacea* subsp. *pendens*, *A. pyrifolia* subsp. *pyrifolia*, *A. trachycarpa*, *Atalaya hemiglauca*, *Melaleuca glomerata* and *Petalostylis labicheoides* over Low Isolated Clumps of Shrubs of *Cullen leucanthum* and *Sesbania cannabina* on red or redbrown sand, sandy loam or sandy clay in drainage lines associated with ephemeral pools.	'Potential (localised patches)'	*E. camaldulensis* is a dominant taxon (some areas had dense cover), and *S. cannabina* and *M. glomerata* were also recorded; however, as the depth to groundwater is generally mapped at >10m throughout this VT, these patches could be localised only. Ephemeral pools were noted, and this VT was associated with sandy to clay substrates, which may indicate a reliance on surface water only. Potential GDV areas may be located where groundwater is within 10m of the ground surface.
13: Low Isolated Clumps of Trees to Mid Open Woodland of *Eucalyptus victrix* (occasionally with *Corymbia hamersleyana* and *Eucalyptus camaldulensis*) over Tall Sparse Shrubland to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia*, *A. trachycarpa* and *Atalaya hemiglauca* over Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* over Low Isolated Clumps of Shrubs of **Aerva javanica*, *Gossypium australe* and *Sida rohlenae* subsp. *rohlenae* on redbrown or red sand or sandy loam in drainage lines and stony outwash areas associated with drainage lines.	'Potential (localised patches)'	The main upper stratum tree layer was dominated by non-phreatophytic taxa; although *E. camaldulensis* occurred it did not dominate. However, the majority of the mapped area of this VT has access to groundwater, with no impeding layer as it occurs on sandy to sand loams on drainage lines. Potential GDV areas may be located where groundwater is within 10m of the ground surface.
7: Low Isolated Clumps of Trees to Mid Open Woodland of *Corymbia hamersleyana*, *Eucalyptus leucophloia* subsp. *leucophloia* and/or *E. victrix* (occasionally *C. candida* subsp. ?*dipsodes*) over Tall Sparse to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia* and *A. tumida* var. *pilbarensis* (occasionally *A. acradenia*, *A. inaequilatera*, *A. eriopoda*, *A. trachycarpa*, *Ehretia saligna* var. *saligna* and *Grevillea wickhamii* subsp. *hispidula*) over Mid Isolated Clumps of Shrubs to Mid Shrubland of *Acacia acradenia*, *A. bivenosa* and/or *A. trachycarpa* (occasionally **Aerva javanica*, *Gossypium australe*, *Carissa lanceolata*, *Petalostylis labicheoides*, *Santalum lanceolatum* or *Scaevola spinescens*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Corchorus parviflorus* and/or *Indigofera monophylla* on brown to red-brown sandy loam, sandy clay, clay loam or sand in drainage lines (of any size) and associated floodplains adjacent to the main range.	'Potential (localised patches)'	Although *Sesbania cannabina* was recorded in this VT, it was not widespread nor a dominant taxon in this VT. As a whole, the vegetation is more likely to be dependent upon surface water drainage. However, localised areas of potential GDV may be present where the groundwater naturally occurs within 10m of the surface (Figure 15).

Atlas Iron required ground truthing of riparian vegetation within the McPhee Creek survey area to confirm Woodman's interpretation of groundwater dependence. However, due to lack of access this was not possible during the allocated field survey time.

3 FLORA AND VEGETATION SURVEY METHODS

3.1 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a Detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016c). The EPA considers that a Detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of the survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition and condition.

3.2 METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016c), conducted as a single-phase survey. The survey was within the period considered optimal for a primary season of survey within the bioregion, being conducted during April 2020.

Conservation criteria used in this assessment are included in **Table 17** and **Table 18** in **Appendix One**.

Survey method details are outlined below.

3.2.1 FLORISTIC QUADRATS

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values, and field observations to best represent the vegetation values existing at the site. The unmarked quadrats were 50 m x 50 m in dimension, as required according to the Flora and Vegetation Technical Guidance 2016. Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 2,500 m^2.

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat

- soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the Detailed survey where there was sufficient extent.

All quadrat locations are displayed on the **Map 6** series.

3.2.2 TARGETED SEARCHES

PF identified during the desktop analysis and previous surveys as known or having the potential to occur were targeted for searches in areas of potential habitat (noting that no TF have been recorded from within 50 km of the survey area and are, therefore, highly unlikely to occur).

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time
- reproductive status and other features such as the health of plants, percentage flowering and fruiting
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

Approximately four field person days were dedicated to targeted searches.

3.2.3 INTRODUCED SPECIES

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

The field survey included searches for WONS and Declared Pest plants. Their locations and numbers/extents were recorded where noted during the field survey, and each WONS or Declared Pest plant species photographed.

3.2.4 VEGETATION DESCRIPTION AND CLASSIFICATION

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group 2017) (**Table 20** and **Table 21** in **Appendix One**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based in the broader vegetation. Vegetation codes were formulated using the first letter of genus and species names of the dominant species of each stratum, e.g. **ChAiTe** refers to ***C****orymbia* ***h****amersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland over ***A****cacia* ***i****naequilatera*, *A. bivenosa* and *Indigofera monophylla* low isolated shrubland over ***T****riodia* ***e****pactia* low hummock grassland. Where more than one species has the same code they are distinguished by using the second letter of the species name e.g. **Cca** refers

to *Corymbia candida* subsp. *dipsodes* whereas **Cci** refers to **Cenchrus ciliaris*. Where the dominant species make up more than one version of the same code they are distinguished by a number at the end of the code (e.g. **AiTw1**).

3.2.5 VEGETATION CONDITION ASSESSMENT

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Eremaean and Northern Botanical Provinces (EPA 2016c) (**Table 22** in **Appendix One**). As quadrats are positioned in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

In areas that were not accessible or accessed during the field survey, including where proposed development areas have altered since the field survey, vegetation condition is extrapolated based adjacent areas and surveyor understanding of likely disturbance factors, particularly grazing in favoured areas.

3.3 MAPPING

Some parts of the survey area were not accessible or accessed during the field survey, leading to a variety of techniques being used to define and describe the vegetation within the overall survey area, as below.

3.3.1 GROUND-TRUTHED FIELD SURVEY

The main body of the survey area and accessible areas of proposed roads were subject to field survey in 2020; these are referred to as 'survey area' (without qualification) in the mapping data.

3.3.2 EXTRAPOLATED SURVEY AREA

Part of the nominated survey area corresponding with a proposed haul road was not accessible during the field survey due to asbestos contamination. A further section was included in the survey area after the field survey had been completed (GIS data provided on 22 June 2020, after submission of the draft report).

The vegetation types and condition in these parts were extrapolated from adjacent areas using aerial imagery interpretation and the surveyor's understanding of the landscape based on the conditions in nearby areas. Survey limitations are detailed in **Section 0**. The aerial imagery interpretation utilised identifiable factors including landscape position, slope, presence or absence of trees and large shrubs, colour and density of grass layer and substrate colour and intensity to compare with adjacent areas and thus adjacent vegetation types. Changes in these factors were used to indicate changes in vegetation types. Land systems, which take into consideration vegetation, topography and geology GIS layers were also used as a guide to determine if nearby vegetation was likely to be similar.

Some creeklines within the area that were inaccessible during the field survey had previously been surveyed by Woodman (2014b); the vegetation type and condition assessment and mapping in these areas were interpolated from previous results, and are indicated on maps and data as the following (interpolated mapping) rather than extrapolated mapping.

Note that extrapolated vegetation mapping does not indicate presence or absence of conservation-listed species.

3.3.3 INTERPOLATED SURVEY AREA

The creeklines to the southeast of the main body of the survey area were not accessed during the 2020 field survey. Previous vegetation mapping by Woodman (2014b), which is Ecoscape's opinion is accurate although more detailed than required according the Flora and Vegetation Technical Guidance (EPA 2016c) i.e. mapped

as Level VI rather than Level V according to the NVIS system (NVIS TWG 2017), along with the floristic quadrat data, was used to determine vegetation types in the area.

The vegetation types along the creeklines are considered to represent interpolated vegetation types.

3.3.3.1 Groundwater Dependence

The classification of vegetation as being representative of a GDV or potential GDV took into consideration the following:

- interpolated vegetation type (see above)
- depth to groundwater, as per **Section 2.5.1.4**, with 10 m below the ground surface being considered as the maximum depth at which tree roots are likely to be able to extend to access groundwater. GIS data was not available, and depth to groundwater was taken from maps in Woodman (2014b; 2019a) reports, georeferenced where possible and extrapolated (and therefore estimated) where there was insufficient coverage. Areas with insufficient coverage were close to Nullagine River thus likely have groundwater close to the surface.
- presence or absence of phreatophytic (or potentially phreatophytic) species, principally *Eucalyptus camaldulensis* that was considered, where depth to groundwater is less than 10 m, to be an obligate phreatophyte (and a facultative phreatophyte where depth to groundwater is greater), and *Eucalyptus victrix*, which may be potentially phreatophytic (i.e. facultatively phreatophytic) where it can access groundwater (i.e. less than 10 m to groundwater) or a vadophyte where it is unlikely to be able to access groundwater.

GDV was considered, in agreeance with Woodman's earlier assessment, to be indicated by the presence of a vegetation type characterised by *Eucalyptus camaldulensis* although other phreatophytic or potentially phreatophytic species may also be present, where depth to groundwater was less than 10 m.

Potential GDV was considered to occur where the potential/facultative phreatophytic *Eucalyptus victrix* was present as a characteristic species, where the depth to groundwater was less than 10 m below the surface, or presence of *Eucalyptus camaldulensis* where groundwater was more than 10 m below the surface. Presence of *Eucalyptus victrix* in areas where groundwater is typically more than 10 m below the surface is unlikely to represent GDV.

3.4 STATISTICAL ANALYSIS

3.4.1 FLORISTIC ANALYSIS

Interpretation of floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units; however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

JUICE software (Tichý 2002) was used to assist in the translation of non-hierarchical data (quadrats) into a system of hierarchical floristic groups based on species co-occurrence. To that end, we applied the OptimClass (Tichý *et al.* 2010) routine (through JUICE) to achieve the following: (1) to identify the most robust choice of data transformation, resemblance measure and clustering algorithm, and (2) to assist in the selection of the optimal number of clusters. The OptimClass routine is intuitive; it promotes the choice of data transformation, resemblance measure and clustering algorithm which produces a 'robust classification'. Essentially a

classification is considered robust when the floristic groups are defined by a high number of 'diagnostic species' (i.e. species which occur at a high frequency within a floristic group and a low rate across other groups).

The application of JUICE and OptimClass is prevalent across Europe (Indreica 2012; Lengyel *et al.* 2016; Purger *et al.* 2014), Africa (Lötter *et al.* 2013) and is gaining momentum as an expert tool designed to assist ecologists in vegetation classification within Western Australia (Mucina *et al.* 2019; Mucina & Daniel 2013; Tsakalos *et al.* 2019).

Vegetation Type descriptions were developed using three main features: 'diagnostic', 'constant' and 'dominance'. The IndVal procedure as offered by Dufrêne and Legendre (1999) and presented in the R package *labdsv* (Roberts 2016) was used to identify diagnostic species ($P \leq 0.05$). Species occurring in greater than 50% of the quadrats in a vegetation type were defined as constant. Species with greater than 3% project cover abundance (%) were defined as dominant.

3.4.2 MULTIVARIATE PATTERNS AND DRIVERS

To identify broad environmental drivers explaining the vegetation type patterns we applied a distance-based redundancy analysis (db-RDA; Legendre & Anderson M.J. 1999). A db-RDA is an ordination method used to visually present and interpret the environmental drivers of the newly defined vegetation types. This method was applied to enhance the descriptions of the environment in which the vegetation types occur. The datasets used in the dB-RDA analysis include the species × site data generated and a newly defined environmental dataset.

The environmental data was collected using CSIRO's TERN soil layers (Viscarra Rossel *et al.* 2015) and topographic variables (aspect, elevation and slope). The topographic variables were derived from NASA Earth Explorer's non-void filled radar topographic mission series at a 90 m resolution (Farr *et al.* 2007). The Soil and Landscape Grid of Australia provides relevant, consistent, comprehensive, nation-wide data in an easily accessible format at a 90 m resolution. The specific soil variables that were used in the environmental data were:

- Bulk Density (BD; Bulk Density of the whole soil (including coarse fragments) in mass per unit volume by a method equivalent to the core method)
- Organic Carbon (C; Mass fraction of carbon by weight in the <2 mm soil material as determined by dry combustion at 900 Celcius)
- Clay (Clay; < 2 um mass fraction of the <2 mm soil material determined using the pipette method)
- Silt (Silt; 2-20 um mass fraction of the <2 mm soil material determined using the pipette method)
- pH (pH; pH of 1:5 soil/0.01M calcium chloride extract)
- Available Water Capacity (AWC; Available water capacity computed for each of the specified depth increments)
- Total Nitrogen (TN; Mass fraction of total nitrogen in the soil by weight)
- Total Phosphorus (TP; Mass fraction of total phosphorus in the soil by weight)
- Effective Cation Exchange Capacity (ECEC; Cations extracted using barium chloride (BaCl2) plus exchangeable H + Al)
- Depth of Regolith (DOR; Depth to hard rock. Depth is inclusive of all regolith)
- Depth of Soil (DOS; Depth of soil profile (A & B horizons)).

All calculations were conducted using the Vegan package (Oksanen *et al.* 2019) in the R statistical Program (R Core Team 2019).

3.4.3 ADEQUACY OF SAMPLING

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software *Species Diversity and Richness IV* (Pisces Conservation Ltd 2010) using five random selections of sample order, and using quadrat data only.

Species accumulation curves were also generated using the *specaccum* function offered by the vegan R package (Oksanen *et al*. 2007). A separate curve was generated for floristic data collected by Woodman during 2014 and 2019 (Woodman Environmental Consulting Pty Ltd 2014c; Woodman Environmental Consulting Pty Ltd 2019a) and the newly established quadrats. Confidence intervals for each curve were generated by adding random quadrats using 1000 permutations.

4 RESULTS

4.1 FLORA AND VEGETATION SURVEY

4.1.1 FIELD SURVEY TIMING

The 2020 Ecoscape field survey was conducted by Dr James Tsakalos (Senior Botanist, flora licence FB62000163 and Threatened Species Licence TFL 58-1920) and assisted by Ms Bronte Winterbottom (Botanist). The field survey was conducted during the 9–19 April, which is within the optimal period for a primary survey within the Pilbara bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016c). The rainfall before the field survey was above average, with 91% of the mean rainfall in the 5 months before the survey (**Figure 3**). Most of this rainfall followed Tropical Cyclone Blake during January 2020, approximately 3 months before the survey.

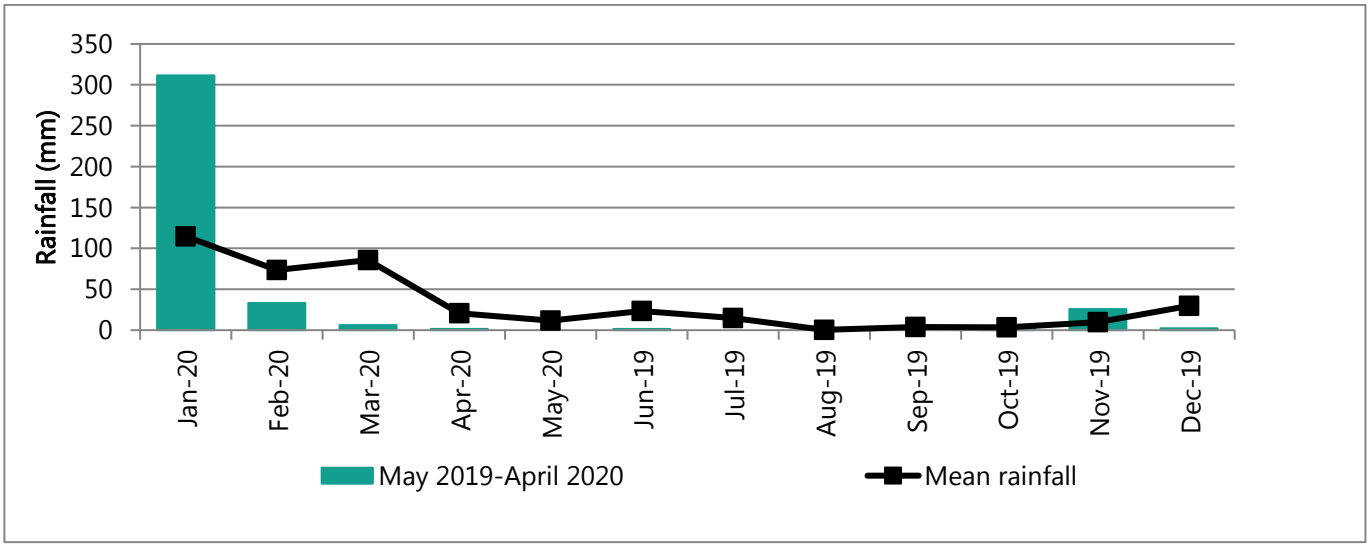


Figure 3: Mean rainfall and rainfall before the field survey(Marble Bar, BoM 2020a)

Where noted, the results that follow take into consideration previous mapping and floristic quadrat data from earlier Woodman surveys.

4.1.2 FLORA

The combined site x species table for all quadrats within the survey area and Ecoscape 2020 opportunistic observations is **Table 24** in **Appendix Three**. Ecoscape 2020 quadrat data is presented in **Appendix Four**.

4.1.2.1 2020 Ecoscape Survey

Forty-two quadrats were established during the 2020 Ecoscape field survey, resulting in 224 vascular flora being recorded from 34 families and 97 genera from the quadrats and opportunistic observations.

The most represented families were Fabaceae with 51 taxa, Poaceae (42 taxa) and Malvaceae (24 taxa). The most represented genera were *Acacia* with 26 taxa, *Ptilotus* (nine taxa) and *Senna* (nine taxa). The most frequently recorded taxa were *Triodia epactia* (from 33 quadrats), *Indigofera monophylla* (32) and *Corchorus parviflorus* (31). A small portion (6.7%) of the flora could not be identified with certainty due to the lack of reproductive material largely due to the slightly below average seasonal conditions and intensive grazing.

The number of species per quadrat ranged from 11 (quadrat MC20Q20) to 50 (quadrat MC20Q12). The average species diversity per quadrat was 28; there was no significant difference (P = 0.806) between the average species diversity per quadrat between existing surveys.

4.1.2.2 Combined

Incorporating the Ecoscape 2020 quadrats and opportunistic observations, plus all quadrats established by Woodman within the survey area (including creeklines) over a number of survey periods, the following have been recorded from within the entire survey area:

- 182 floristic quadrats
- 370 vascular flora taxa including five conservation-listed species (see **Section 4.1.3** below) and 16 introduced species (see **Section 4.1.5** below).

4.1.3 CONSERVATION-LISTED FLORA

No Commonwealth EPBC Act or Western Australian BC Act-listed Threatened Flora were recorded during the field survey, nor were anticipated to occur as none have been previously recorded from within 50 km of the survey areas.

Three PF were recorded during 2020, summarised in **Table 9** and described in more detail in **Table 10**. Locations are presented in the **Map 5** series.

Table 9: Summary of Priority Flora recorded within survey area during 2020

Status	Taxon	# Locations	# Individuals
P1	*Acacia aphanoclada*	80	2,000
P3	*Rostellularia adscendens* var. *latifolia*	1	2
P4	*Ptilotus mollis*	1	4

4.1.3.1 Previously Recorded Conservation-Listed Flora

Two Priority-listed flora taxa (*Eragrostis crateriformis* and *Goodenia nuda*) have been previously recorded from the survey areas; these were not recorded during the survey.

Eragrostis crateriformis (P3)

There are 63 locations of *Eragrostis crateriformis* located within the McPhee Creek survey area along the entry road; these records are from previous surveys (Woodman 2014c; 2014d). During the 2020 survey the location and surrounding area were searched and several (n = 4) collections of annual *Eragrostis* spp. matching the description were collected throughout the survey area, however, no *Eragrostis crateriformis* plants were located. Several of these locations along roads in depressions on clayey loam and clay were rechecked; it is considered likely that *Eragrostis crateriformis* has a scattered/sporadic distribution within the survey area and responds strongly to seasonal rainfall events. We consider that the identification of this species by Woodman is likely to be correct.

Goodenia nuda (P4)

There is one record of *Goodenia nuda* located ca. 2 km southwest of the McPhee camp; this record is from a previous survey (Woodman 2014c). This previous record was not vouchered, and inspection of Woodman's identification notes suggested that the collection was not a perfect match for this taxon. Further, although retained in Atlas Iron's GIS data, Woodman (2019a, p111) suggests this was a mis-identification. During the 2020 survey the adjoining drainage line vegetation close to where the record was located was checked and

several independent collections were made for the taxon; no *Goodenia nuda* plants were confirmed. Therefore, it is likely that this species has been incorrectly identified in the past.

Table 10: Priority Flora species recorded from the survey

Acacia aphanoclada				
	Description (WAH 1998-2020; 2020)	Habitat (WAH 1998-2020; 2020)	Survey Results	Photograph
P1	Slender, wispy, glabrous, single-stemmed shrubs to 5 m tall. Flowers yellow from August–October.	This taxon has been recorded from rocky spinifex (*Triodia* spp.) hills with scattered eucalypts and acacias. Occurs on Mosquito Creek sediments and on conglomerates. Distribution: 44 records from the Chichester area in the Pilbara region.	**Records**: 80 locations featuring over 2,000 individual plants. **Populations**: 1 large population along the haul road to the south-west of the survey area. **Habitat**: Occurs at high frequencies in the **ChAiTe** vegetation type	
Rostellularia adscendens* var. *latifolia				
	Description (WAH 1998-2020; 2020)	Habitat (WAH 1998-2020; 2020)	Survey results	Photograph
P3	Herb or shrub growing to 0.1–0.3 m high with blue-purple-violet flowers in April and May.	This taxon has been recorded from ironstone soils, near creeks and on rocky hills. Distribution: 42 records from the Ashburton and East Pilbara areas in the Pilbara region. 313 records from New South Wales, the Northern Territory, Queensland and South Australia.	**Records**: 1 location totaling 2 individuals. **Populations**: 1 small population along the haul road to the north-east of the survey area. **Habitat**: Occurs in the **EvApyCci** vegetation type	

Ptilotus mollis				
	Description (WAH 1998-2020; 2020)	**Habitat (WAH 1998-2020; 2020)**	**Survey results**	**Photograph**
P4	Hairy, compact erect perennial shrub growing to 0.5 m high with pink/white flowers.	Has been recorded from rock piles, scree, gorges, riverbeds and alluvial soils. Distribution: 37 records from the Chichester, Hamersley, Roebourne and Rudal areas in the Little Sandy Desert and Pilbara regions.	**Records**: 1 location totaling 4 individuals. **Populations**: 1 population to the north-east of the survey area. **Habitat**: Occurs at high frequencies in the **ChAiTe** vegetation type	

4.1.3.2 Post-survey Likelihood Assessment

Following field survey, when additional information was available regarding actual habitat availability and searches have been conducted, the likelihood of conservation-listed flora occurring in the survey area was revised. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 23** in **Appendix Two**.

The likelihood of detection was decreased for four species; all other species remained unchanged. No species that have not previously been recorded were considered likely to occur (i.e. have a High likelihood of occurring) in the survey area.

4.1.4 OTHER SIGNIFICANT FLORA

None of the flora taxa recorded from the survey area are considered to represent range extensions of any significance.

4.1.5 INTRODUCED FLORA

Seven introduced flora species (weeds), representing 3.13% of the total flora species, were recorded during the 2020 field survey (**Table 11**). **Cenchrus ciliaris* (Buffel grass) was the most recorded introduced species occurring in 12 of 42 quadrats (30 quadrats from the total of 149 quadrats recorded within the survey area). Buffel Grass (including suspected occurrences) contributed to vegetation condition assessment along drainage lines.

One of the introduced flora species (**Calotropis procera*, Rubber Bush; **Image 1** and **Image 2**) is a Declared Pest plant and was found amongst an outcropping in the central survey area; it had not been previously recorded. Locations of introduced species are shown on **Map 7**. Six of the these introduced taxa are ranked as having High ecological impact and rapid invasiveness for the Pilbara Region (Department of Parks and Wildlife [DPaW] 2013); *Calotropis procera* is not listed by DPaW (see below).

Table 11: Ecological impact and invasiveness ratings of introduced flora species recorded from the survey ranked according to DPaW's Pilbara Region Species Prioritisation Process (DPaW 2013)

Species name	Common Name	Number of Records and Individuals in the Survey Area	Ecological Impact (DPaW 2013)	Invasiveness (DPaW 2013)
**Calotropis procera*[A]	Rubber Bush	1 (2)	-	-
Aerva javanica* (Image 3**)	Kapok Bush		High	Rapid
**Cenchrus ciliaris*	Buffel Grass		High	Rapid
**Cenchrus setiger*	Birdwood Grass		High	Rapid
**Cynodon dactylon*	Couch		High	Rapid
**Echinochloa colona*	Awnless Barnyard Grass		High	Rapid
**Malvastrum americanum*	Spiked Malvastrum		High	Rapid

[A]Ranked as a 'Priority Alert' – this species found within the Pilbara Region but not on DPaW managed lands or waters it has not been ranked according to its ecological impact or invasiveness.

Image 1: **Calotropis procera*

Image 2: **Calotropis procera*

Image 3: **Aerva javanica*

Woodman, over all of its surveys encompassing the current survey area, recorded an additional nine introduced species: **Argemone ochroleuca* (Mexican Poppy), **Chloris barbata* (Purpletop Chloris, Feathertop Rhodes Grass), **Citrullus amarus* (Pie Melon), **Euphorbia hirta* (Asthma Plant), **Flaveria trinervia* (Speedy Weed), **Portulaca pilosa* (Djanggara), **Setaria verticillata* (Whorled Pigeon Grass), **Sonchus oleraceus* (Common Sowthistle) and **Vachellia farnesiana* (Mimosa Bush). None are Declared Pest or WoNS species.

4.2 VEGETATION

Vegetation was defined using all existing (140) and new quadrats (42) located within the McPhee Creek survey area, totalling 182 quadrats.

Nineteen vegetation types belonging to two floristic super-groups were recorded from within the survey area (**Table 12)**, based on structural vegetation type as identified in the field, floristic analysis and subsequent desktop review. The extents of the vegetation types and representative quadrat locations are shown on the **Map 6** series. Interpolated (i.e. based on previous Woodman mapping) and extrapolated (i.e. based on adjacent and nearby mapping but not ground-truthed) vegetation types are indicated on these maps. Extents of each vegetation type are shown in **Table 13**.

The split between the three floristic super-groups has both a floristic and environmental foundation. The first supergroup contains vegetation types with emergent/dominant *Eucalyptus leucophloia* subsp. *leucophloia* (i.e. woodlands and isolated trees) coupled with *Acacia monticola, Acacia ptychophylla, Triodia brizoides* and *Triodia epactia* as diagnostic species (i.e., $P < 0.05$). The second floristic supergroup contains a different suite of upper stratum trees and higher densities of tussock grasses with the following species considered diagnostic: *Eucalyptus victrix, E. camaldulensis*, *Atalaya hemiglauca* and Cenchrus ciliaris. The third floristic supergroup contains high densities of mixed shrublands with the following species considered diagnostic: *Acacia inaequilatera* and *Triodia wiseana*.

Distance-based redundancy analysis performed on the synoptic table and environmental data shows a clear split between the three super-groups (**Figure 4**). The first (grey) and third (green) supergroups occupy areas in the landscape featuring high elevation and slope (i.e. hillslopes and crests), clay, silt, and soil organic carbon compared to the second (red) and third (green) supergroups. The third supergroup occupies lower sloping areas (i.e. foothills) in the landscape featuring deeper soil (DES), regolith (DER) and higher available water capacity (AWC) compared to the first supergroup. The second supergroup is located in low elevation and low slope (i.e. flat) areas in the landscape and contains high AWC.

The vegetation types recorded from the survey area can be broadly grouped based on the following landform types:

- predominantly hillcrests/hillslopes: **AiTw2**, **AiTw1,** **CcaAiTe**, **ChAiTe**, **ChAiTa**, **ChAiTw**, **ElAbTe**, **ElAptTe**, **ElAmTb**, **ElAmTe**, **ElGwTe**
- stony plains: **AoTl**, **AsTe**, **AsTl**, **AtTe**
- predominantly drainage lines: **ChAmTe**, **ChApyTt**, **EcApyCci**, **EvApyCci**.

A summary of consolidated vegetation types (i.e. those previously described during the earlier Woodman surveys) and the vegetation type units described herein is provided in **Table 25** in **Appendix Three**.

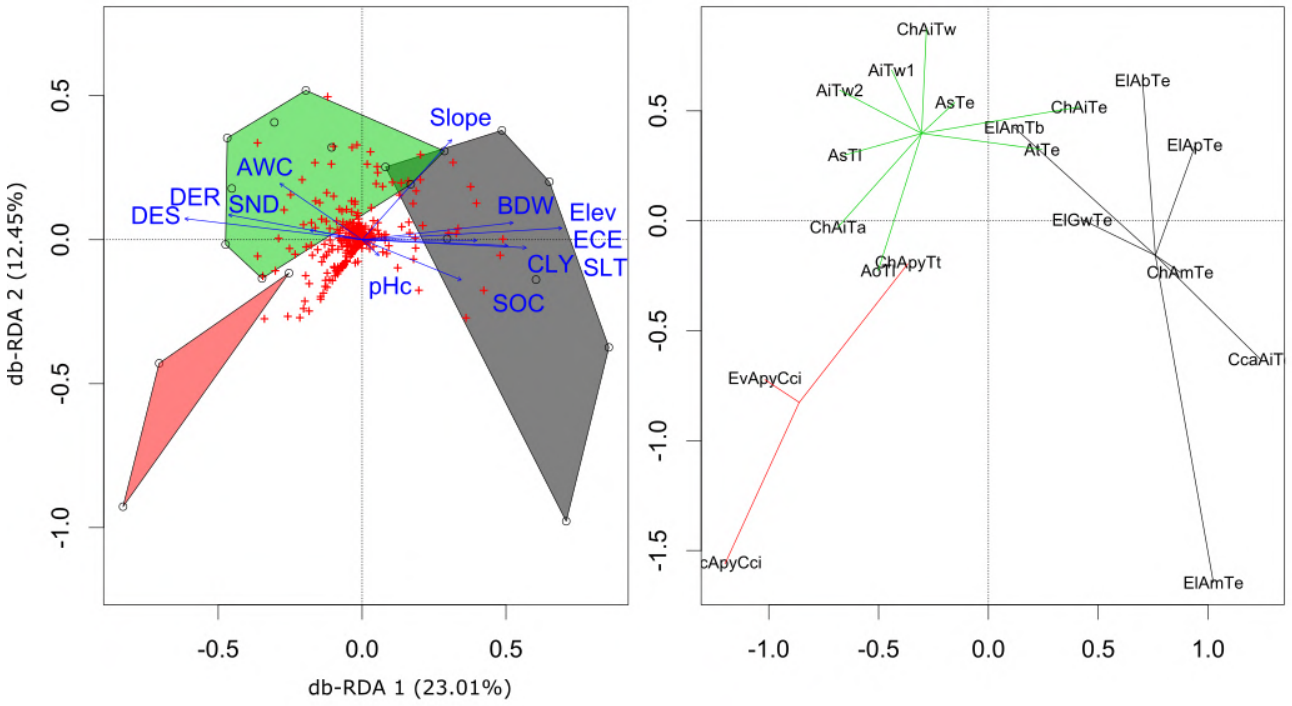


Figure 4: Distance-based redundancy analysis of the McPhee Creek vegetation

Table 12 Vegetation types

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Stony Plain/Hillcrest/Hillslope	**AiTw1** MC048 MC050 MC053 MC059 **MC066** MC072 MC108 MC110 MC121 MC122 MC129 MC153	*Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Swainsona decurrens, Triodia wiseana* **Constant:** *Acacia inaequilatera, Triodia wiseana, Senna symonii, Senna glutinosa* subsp. *glutinosa, Swainsona decurrens* **Dominant:** *Triodia wiseana, Triodia longiceps, Acacia bivenosa, Corymbia hamersleyana, Acacia inaequilatera, Acacia orthocarpa*
Hillcrest/Hillslope	**AiTw2** MC012 MC051 MC130 MC131 MC20OP01 **MC20Q13** MC20Q16 MC20Q17 RC415	*Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* and *T. longiceps* mid hummock grassland		**Diagnostic:** *Boerhavia coccinea, Bulbostylis barbata, Sida echinocarpa, Tragus australianus* **Constant:** *Acacia inaequilatera, Aristida contorta, Bulbostylis barbata, Sida echinocarpa, Cleome viscosa, Fimbristylis dichotoma, Triodia wiseana, Boerhavia coccinea, Corchorus lasiocarpus* subsp. *lasiocarpus, Hibiscus sturtii* agg., *Senna glutinosa* subsp. *glutinosa x luerssenii, Triumfetta clementii, Gomphrena cunninghamii, Indigofera monophylla, Senna artemisioides* subsp. *oligophylla, Senna glutinosa* subsp. *pruinosa, Triodia brizoides, Triodia longiceps* **Dominant:** *Triodia epactia, Triodia brizoides, Triodia wiseana, Acacia synchronicia, Acacia bivenosa, Heliotropium crispatum, Triodia longiceps, Acacia orthocarpa, Gossypium australe, Acacia inaequilatera*

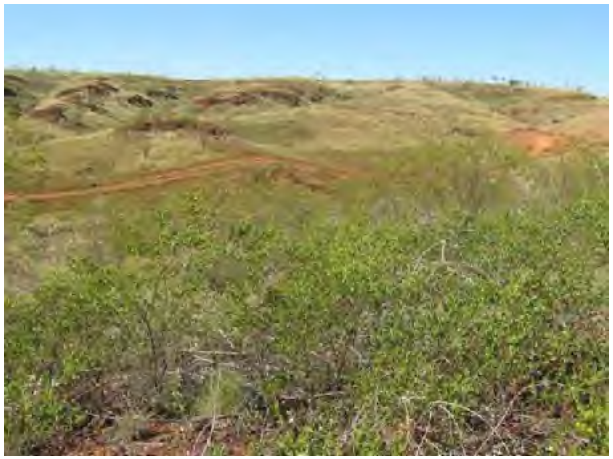
Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Stony Plain	**AoTl** MC20Q22 **MC20Q23** MC20Q25	*Acacia orthocarpa, A. monticola* and *A. bivenosa* low sparse shrubland over *Triodia longiceps* and *T. epactia* low hummock grassland		**Diagnostic:** *Acacia orthocarpa, Alysicarpus muelleri, *Cenchrus setiger, Euphorbia* sp., *Triodia longiceps* **Constant:** *Acacia bivenosa, Acacia monticola, Acacia orthocarpa, Alysicarpus muelleri, Fimbristylis dichotoma, Rhynchosia minima, Triodia longiceps, Acacia inaequilatera, *Cenchrus ciliaris, *Cenchrus setiger, Corchorus parviflorus, Euphorbia* sp. , *Goodenia microptera, Indigofera linifolia, Pluchea ferdinandi-muelleri, Senna artemisioides* subsp. *helmsii, Senna glutinosa* subsp. *glutinosa, Senna symonii, Sporobolus australasicus, Stemodia grossa, Triodia epactia* **Dominant:** *Triodia longiceps, Triodia epactia, Acacia monticola, Acacia bivenosa*
Stony Plain	**AsTe** **MC20OP03** MC20Q05 MC20Q19	*Acacia synchronicia, A. bivenosa, A. inaequilatera* tall open shrubland over *Triodia epactia* low open hummock grassland		**Diagnostic:** *Goodenia muelleriana, Senna glutinosa* subsp. *glutinosa x luerssenii* **Constant:** *Acacia inaequilatera, Aristida contorta, Cleome viscosa, Corchorus parviflorus, Eriachne pulchella* subsp. *dominii, Goodenia muelleriana, Gossypium australe, Senna glutinosa* subsp. *glutinosa x luerssenii, Sida echinocarpa, Triodia epactia, Acacia acradenia, Acacia bivenosa, Acacia synchronicia, Hibiscus sturtii* agg., *Indigofera monophylla, Ptilotus calostachyus, Senna glutinosa* subsp. *pruinosa, Senna symonii, Sida fibulifera, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Sporobolus australasicus, Themeda triandra, Trigastrotheca molluginea, Triodia wiseana* **Dominant:** *Triodia epactia, Acacia synchronicia, Acacia bivenosa, Acacia inaequilatera*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Stony Plain	**AsTl** MC057 MC146 MC147 MC148 MC150 **MC152**	*Acacia synchronicia* mid isolated shrubs over *Triodia longiceps* and *Triodia wiseana* mid sparse hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Abutilon malvifolium, Abutilon oxycarpum* subsp. Prostrate (A.A. Mitchell PRP 1266), *Aristida contorta, Aristida latifolia, Brachyachne convergens, Carissa lanceolata, Corchorus tridens, Dichanthium sericeum* subsp. *humilius, Eragrostis setifolia, Eriachne pulchella* subsp. *dominii, Euphorbia trigonosperma, Heliotropium cunninghamii, Neptunia dimorphantha, Operculina aequisepala, Ptilotus aervoides, Ptilotus exaltatus, Sclerolaena costata, Senna artemisioides* subsp. *oligophylla, Sporobolus australasicus, Streptoglossa bubakii, Streptoglossa liatroides, Trianthema triquetrum* **Constant:** *Acacia synchronicia, Aristida contorta, Brachyachne convergens, Triodia longiceps, Senna artemisioides* subsp. *oligophylla, Triodia wiseana, Acacia bivenosa, Corchorus lasiocarpus* subsp. *lasiocarpus, Heliotropium cunninghamii, Hibiscus sturtii* agg., *Neptunia dimorphantha, Pluchea tetranthera, Polycarpaea holtzei, Polygala isingii, Ptilotus aervoides, Sclerolaena costata, Senna symonii, Sida fibulifera* **Dominant:** *Triodia wiseana, Triodia longiceps, Eragrostis setifolia, Acacia synchronicia, Chrysopogon fallax, Dichanthium sericeum* subsp. *humilius, Acacia inaequilatera, Sporobolus australasicus, Themeda triandra*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Stony Plain	**AtTe** MC20OP10 MC20OP11 **MC20Q21**	*Acacia trachycarpa* low sparse mallee shrubland over *Triodia epactia* and *T. brizoides* open hummock grassland		**Diagnostic:** *Acacia* sp., *Bonamia erecta, Bonamia pilbarensis, Heliotropium chrysocarpum* **Constant:** *Acacia* sp., *Aristida contorta, Bonamia erecta, Bulbostylis barbata, Eriachne pulchella* subsp. *dominii, Fimbristylis dichotoma, Heliotropium chrysocarpum, Indigofera monophylla, Triodia epactia, Acacia bivenosa, Acacia ptychophylla, Acacia trachycarpa, Bonamia pilbarensis, Corchorus parviflorus, Fimbristylis simulans, Goodenia microptera, Goodenia stobbsiana, Grevillea wickhamii* agg., *Hakea chordophylla, Hibiscus sturtii* agg., *Hybanthus aurantiacus, Pluchea dentex, Polycarpaea longiflora, Ptilotus calostachyus, Scaevola amblyanthera* var. *centralis, Senna notabilis, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Sporobolus australasicus, Trigastrotheca molluginea, Triodia brizoides, Triodia wiseana* **Dominant:** *Triodia brizoides, Triodia epactia, Acacia trachycarpa, Acacia* sp.
Stony Plain/Hillcrest/Hillslope	**CcaAiTe** MC031 **MC034** MC039 MC043	*Corymbia candida* subsp. *dipsodes, C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia inaequilatera, Grevillea wickhamii* subsp. *hispidula* and *Hakea chordophylla* tall isolated shrubs over *Triodia epactia* low hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Amphipogon sericeus, Fimbristylis simulans, Hakea chordophylla, Ptilotus calostachyus* **Constant:** *Amphipogon sericeus, Eriachne lanata, Fimbristylis simulans, Goodenia stobbsiana, Hakea chordophylla, Ptilotus calostachyus, Triodia epactia, Acacia ptychophylla, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Dampiera candicans, Grevillea wickhamii* agg., *Senna glutinosa* subsp. *glutinosa x luerssenii, Senna symonii* **Dominant:** *Triodia epactia, Amphipogon sericeus*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Stony Plain	**ChAiTa** **MC060** MC067 MC073	*Corymbia hamersleyana* low isolated trees over *Acacia inaequilatera* tall isolated shrubs over *Triodia angusta* and *T. wiseana* low hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Stackhousia intermedia, Swainsona stenodonta, Triodia angusta* **Constant:** *Hakea lorea* subsp. *lorea, Swainsona stenodonta, Triodia angusta, Triodia wiseana, Acacia bivenosa, Acacia inaequilatera, Corymbia hamersleyana, Senna symonii, Stackhousia intermedia, Swainsona decurrens* **Dominant:** *Triodia angusta, Triodia wiseana, Corymbia hamersleyana*
Stony Plain/Hillcrest/Hillslope	**ChAiTe** MC014 MC019 MC025 MC045 MC070 MC082 MC084 MC085 MC092 MC096 MC106 MC116 MC120 MC127 MC135 MC20OP04 MC20OP05	*Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland over *Acacia inaequilatera, A. bivenosa* and *Indigofera monophylla* low isolated shrubland over *Triodia epactia* low hummock grassland		**Diagnostic:** NA **Constant:** *Triodia epactia, Acacia inaequilatera, Corchorus parviflorus, Acacia bivenosa, Indigofera monophylla, Senna glutinosa* subsp. *glutinosa, Trigastrotheca molluginea, Goodenia stobbsiana, Ptilotus calostachyus, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Corymbia hamersleyana, Grevillea wickhamii* agg. **Dominant:** *Triodia epactia, Triodia brizoides, Triodia wiseana, Acacia tumida* var. *pilbarensis, Themeda triandra, Triodia longiceps, Indigofera monophylla, Acacia bivenosa, Acacia monticola, Acacia inaequilatera, Acacia synchronicia, Eucalyptus leucophloia* subsp. *leucophloia, Eriachne mucronata, Acacia ptychophylla, Corymbia hamersleyana, Grevillea wickhamii* agg.

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
	MC20OP08 MC20Q02 MC20Q03 **MC20Q04** MC20Q08 MC20Q09 MC20Q14 MC20Q15 MC20Q18 MC20Q20 MC20Q26			
Hillcrest/Hillslope/Stony Plain	**ChAiTw** MC081 MC094 **MC097** MC109 MC20Q01	*Corymbia hamersleyana* low isolated clumps of trees over *Acacia inaequilatera, A. bivenosa* mid open shrubland over *Triodia wiseana* low hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Acacia inaequilatera, Bonamia* sp. Dampier (A.A. Mitchell PRP 217) **Constant:** *Acacia bivenosa, Acacia inaequilatera, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Corchorus parviflorus, Corymbia hamersleyana, Hakea lorea* subsp. *lorea, Triodia wiseana, Indigofera monophylla, Aristida contorta, Eriachne mucronata, Goodenia microptera, Hibiscus sturtii* agg., *Senna glutinosa* subsp. *glutinosa, Sida echinocarpa, Trigastrotheca molluginea* **Dominant:** *Triodia wiseana, Acacia bivenosa, Acacia inaequilatera, Corchorus parviflorus*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Minor Drainage Line/Hillcrest/Hillslope	**ChAmTe** MC003 MC004 MC013 MC017 MC021 MC032 MC035 MC038 MC040 MC104 **MC119**	*Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia monticola, A. tumida* var. *pilbarensis,* and *Grevillea wickhamii*. tall open shrubland over *Triodia epactia and Eriachne lanata low open hummock/ tussock grassland*	 Photo from Woodman (2012)	**Diagnostic:** *Dampiera candicans, Gompholobium oreophilum, Sida* sp. Articulation below (A.A. Mitchell PRP 1605), *Tephrosia virens* **Constant:** *Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Grevillea wickhamii* agg., *Ptilotus calostachyus, Sida* sp. Articulation below (A.A. Mitchell PRP 1605), *Triodia epactia, Dampiera candicans, Goodenia stobbsiana, Acacia tumida* var. *pilbarensis, Corymbia hamersleyana, Fimbristylis simulans, Gompholobium oreophilum, Indigofera monophylla, Acacia monticola, Acacia ptychophylla, Eriachne lanata, Eriachne mucronata, Hibiscus sturtii* agg., *Hybanthus aurantiacus, Senna glutinosa* subsp. *glutinosa, Acacia pyrifolia* agg., *Eucalyptus leucophloia* subsp. *leucophloia, Corchorus parviflorus, Cymbopogon ambiguus, Senna symonii, Triumfetta maconochieana* **Dominant:** *Acacia tumida* var. *pilbarensis, Acacia monticola, Triodia epactia, Eriachne lanata, Eucalyptus leucophloia* subsp. *leucophloia, Dampiera candicans, Eriachne mucronata, Eriachne benthamii, Grevillea wickhamii* agg., *Gompholobium oreophilum, Acacia ptychophylla*
Minor Drainage Line	**ChApyTt** MC042 MC098 MC107 MC111 MC145 MC151 **MC20OP02**	*Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall shrubland over *Themeda triandra, Triodia longiceps* and *Chrysopogon fallax* tall tussock grassland/hummock grassland		**Diagnostic**: *Acacia acradenia, Acacia tumida* var. *pilbarensis, Bothriochloa ewartiana, Chrysopogon fallax, Ehretia saligna* var. *saligna, Eragrostis cumingii, Evolvulus alsinoides* var. *decumbens, Gossypium robinsonii, Hibiscus sturtii* agg., *Jasminum didymum* subsp. *lineare, Melhania oblongifolia, Polymeria ambigua, Santalum lanceolatum, Scaevola spinescens, Themeda triandra* **Constant**: *Acacia acradenia, Acacia bivenosa, Acacia pyrifolia* agg., *Corchorus parviflorus, Acacia tumida* var. *pilbarensis, Enneapogon lindleyanus, Evolvulus alsinoides* var. *decumbens, Grevillea wickhamii* agg., *Hibiscus sturtii* agg., *Hybanthus aurantiacus, Indigofera monophylla, Polymeria ambigua, Senna glutinosa* subsp. *glutinosa, Themeda triandra, Trigastrotheca molluginea, Triodia epactia, Chrysopogon fallax, Cleome viscosa, Corymbia hamersleyana, Cymbopogon ambiguus, Eragrostis cumingii, Euphorbia trigonosperma, Gossypium australe, Melhania oblongifolia, Paraneurachne muelleri, Phyllanthus*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
				maderaspatensis, Rhynchosia minima, Carissa lanceolata, Crotalaria medicaginea var. *neglecta, Dampiera candicans, Ehretia saligna* var. *saligna, Eriachne mucronata, Euphorbia australis, Evolvulus alsinoides var. villosicalyx, Gossypium robinsonii, Jasminum didymum* subsp. *lineare, Sida rohlenae* subsp. *rohlenae, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Trichodesma zeylanicum* var. *zeylanicum, Triodia longiceps* **Dominant:** *Triodia longiceps, Themeda triandra, Acacia acradenia, Acacia tumida var. pilbarensis, Chrysopogon fallax, Acacia bivenosa, Indigofera monophylla, Triodia epactia, Corymbia ferriticola, Grevillea wickhamii* agg., *Acacia pyrifolia* agg., *Corchorus parviflorus, Corymbia hamersleyana, Hibiscus sturtii* agg., *Santalum lanceolatum, Cymbopogon ambiguus, Eucalyptus leucophloia* subsp. *leucophloia, Eucalyptus victrix*
Drainage Line	**EcApyCci** MCC-03 MCC-04 MCC-05 MCC-06 MCC-09 MCC-11 **MCC-12** MCC-13 MCC-14 MCC-15 MCC-16 MCC-17 MCC-18 MCC-19 MCC-20 MCC-21 MCC-22 MCC-23 MCC-24	*Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland over **Cenchrus ciliaris* and *Cyperus vaginata* low tussock grassland/sedgeland	 Photo from Woodman (2019a)	**Diagnostic:** *Acacia ampliceps, Amaranthus cuspidifolius, Ammannia multiflora, Atalaya hemiglauca, Boerhavia schomburgkiana, *Cenchrus ciliaris, Cyperus vaginatus, Echinochloa colona*, Eucalyptus camaldulensis, Eucalyptus victrix, Euphorbia alsiniflora, Euphorbia australis, Marsilea hirsuta, Sesbania cannabina, Stemodia grossa, Vigna lanceolata* var. *lanceolata, *Argemone ochroleuca, Centipeda minima* subsp. *macrocephala, Cullen leucanthum, Ipomoea muelleri, Leptochloa fusca* subsp. *fusca, *Sonchus oleraceus* **Constant**: *Atalaya hemiglauca, *Cenchrus ciliaris, Cyperus vaginatus, Eucalyptus camaldulensis, Acacia pyrifolia* agg., *Eucalyptus victrix, Triodia longiceps, Phyllanthus maderaspatensis, Acacia trachycarpa, *Echinochloa colona, Euphorbia australis, Sesbania cannabina, Stemodia grossa, Amaranthus undulatus, Vigna lanceolata var. lanceolata, Melaleuca glomerata, Pluchea tetranthera, Centipeda minima subsp. macrocephala, Cleome viscosa, Euphorbia alsiniflora, Evolvulus alsinoides* var. *villosicalyx, Rhynchosia minima* **Dominant**: **Cenchrus ciliaris, Eucalyptus camaldulensis, Eucalyptus victrix, Cyperus vaginatus, Eriachne benthamii, Acacia trachycarpa, Melaleuca glomerata, Melaleuca bracteata, Acacia*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
	MCC-29 MCC-30 MCC-31 MCC-32 MCC-33 MCC-34 MCC-38			*coriacea* subsp. *pendens, Acacia pyrifolia* agg., **Cynodon dactylon, *Echinochloa colona, Atalaya hemiglauca, Acacia ampliceps*
Hillcrest/Hillslope	**ElAbTe** MC018 MC023 MC030 MC036 MC041 MC044 MC099 MC100 MC105 MC149 **MC20OP06** MC20OP12 MC20Q07	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia bivenosa, A. ptychophylla* and *A. monticola* mid shrubland over *Triodia brizoides, T. epactia* and *Cymbopogon ambiguus* mid hummock/tussock grassland		**Diagnostic:** NA **Constant:** *Corchorus parviflorus, Eucalyptus leucophloia* subsp. *leucophloia, Indigofera monophylla, Senna glutinosa* subsp. *glutinosa, Senna symonii, Triodia epactia, Acacia inaequilatera, Cymbopogon ambiguus, Ptilotus calostachyus, Triodia brizoides, Acacia bivenosa, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Eriachne mucronata, Goodenia triodiophila, Polycarpaea holtzei, Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 0356), *Bulbostylis barbata, Goodenia stobbsiana, Dampiera candicans, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Trigastrotheca molluginea* **Dominant:** *Triodia brizoides, Triodia epactia, Triodia wiseana, Acacia bivenosa, Eucalyptus leucophloia* subsp. *leucophloia, Acacia ptychophylla, Acacia pyrifolia* agg., *Senna symonii*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Hillcrest/Hillslope	**ElAmTb** MC142 MC143 MC20OP07 MC20OP13 **MC20Q06**	*Eucalyptus leucophloia* subsp. *leucophloia* low woodland over *Acacia monticola* mid isolated clumps of shrubs over *Triodia brizoides* and *T. epactia* low hummock grassland		**Diagnostic:** *Cheilanthes brownii, Clerodendrum floribundum, Hibiscus coatesii, Ptilotus obovatus, Triodia brizoides* **Constant:** *Eriachne mucronata, Eucalyptus leucophloia* subsp. *leucophloia, Fimbristylis dichotoma, Hibiscus coatesii, Senna symonii, Triodia brizoides, Acacia monticola, Corchorus parviflorus, Cymbopogon ambiguus, Goodenia triodiophila, Hakea lorea* subsp. *lorea, Pluchea tetranthera, Senna glutinosa* subsp. *glutinosa, Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 0356), *Bulbostylis barbata, Cheilanthes brownii, Enneapogon lindleyanus, Evolvulus alsinoides* var. *villosicalyx, Indigofera monophylla, Polycarpaea holtzei, Ptilotus calostachyus, Ptilotus obovatus, Senna glutinosa* subsp. *pruinosa, Tribulus suberosus* **Dominant:** *Triodia brizoides, Eriachne mucronata, Acacia bivenosa, Acacia monticola, Eucalyptus leucophloia* subsp. *leucophloia, Cymbopogon ambiguus, Triodia wiseana, Triodia epactia*
Hillcrest/Hillslope	**ElAmTe** **MC046** MC069 MC20Q24	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia monticola, A. bivenosa* and *Grevillea wickhamii*. shrubland over *Triodia epactia, Eriachne lanata* mid hummock/tussock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Acacia monticola, Eriachne lanata* **Constant:** *Acacia monticola, Eriachne lanata, Goodenia stobbsiana, Grevillea wickhamii* agg., *Triodia epactia, Sida* sp. Pilbara (A.A. Mitchell PRP 1543) **Dominant:** *Acacia monticola, Eriachne lanata, Triodia epactia, Grevillea wickhamii* agg.

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Hillcrest/Hillslope	**ElAptTe** MC002 MC011 MC015 MC016 MC022 **MC024** MC029 MC037 MC086 MC088 MC124 MC128	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland over *Acacia ptychophylla, A. inaequilatera* and *Indigofera* monophylla low isolated shrubland over *Triodia epactia, T. brizoides* low hummock grassland	 Photo from Woodman (2019a)	**Diagnostic:** *Acacia ptychophylla, Dodonaea coriacea, Eriachne ciliata, Goodenia triodiophila* **Constant:** *Eriachne ciliata, Eucalyptus leucophloia* subsp. *leucophloia, Triodia epactia, Acacia ptychophylla, Corymbia hamersleyana, Dampiera candicans, Goodenia stobbsiana, Goodenia triodiophila, Indigofera monophylla, Dodonaea coriacea, Fimbristylis dichotoma, Polygala isingii, Senna glutinosa* subsp. *glutinosa, Grevillea wickhamii* agg., *Triodia brizoides, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Fimbristylis simulans, Polycarpaea holtzei* **Dominant:** *Triodia epactia, Triodia brizoides, Acacia ptychophylla, Acacia retivenea* subsp. *clandestina, Eucalyptus leucophloia* subsp. *leucophloia, Dampiera candicans, Grevillea wickhamii* agg., *Acacia inaequilatera, Corymbia hamersleyana, Acacia bivenosa, Acacia orthocarpa*
Hillcrest/Hillslope	**ElGwTe** MC047 **MC063** MC064 MC068	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated clumps over *Senna glutinosa* subsp. *glutinosa* and *Grevillea wickhamii*. tall open shrubland over *Triodia epactia* and *Eriachne mucronata* mid hummock grassland/ mid isolated clumps of tussock grasses	 Photo from Woodman (2019a)	**Diagnostic:** *Amaranthus undulatus, Clerodendrum tomentosum* var. *lanceolatum, Eriachne mucronata, Eucalyptus leucophloia* subsp. *leucophloia, Hibiscus goldsworthii, Ptilotus incanus, Senna glutinosa* subsp. *glutinosa, Sida ?*macropoda (complex), *Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Triodia epactia* **Constant:** *Amaranthus undulatus, Aristida contorta, Bonamia* sp. Dampier (A.A. Mitchell PRP 217), *Cymbopogon ambiguus, Eriachne mucronata, Eucalyptus leucophloia* subsp. *leucophloia, Grevillea wickhamii* agg., *Pluchea tetranthera, Ptilotus calostachyus, Senna glutinosa* subsp. *glutinosa, Sida ?macropoda* (complex), *Sida rohlenae* subsp. *rohlenae, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Triodia epactia, Acacia bivenosa, Corchorus lasiocarpus* subsp. *lasiocarpus, Goodenia stobbsiana, Hibiscus coatesii, Hibiscus goldsworthii, Pluchea ferdinandi-muelleri, Ptilotus incanus* **Dominant:** *Triodia epactia, Eriachne mucronata, Eucalyptus leucophloia* subsp. *leucophloia, Senna glutinosa* subsp. *glutinosa, Grevillea wickhamii* agg., *Goodenia stobbsiana*

Land-form	Mapping Unit and Floristic Quadrats	Vegetation Type	Representative Photograph	Other Characteristic Species
Drainage Line	**EvApyCci** MC074 MC091 MC093 MC125 MC144 MC20OP09 MC20OP14 MC20Q10 MC20Q11 MC20Q12 **MC20Q27** MCC-01 MCC-02 MCC-07 MCC-08 MCC-10 MCC-25 MCC-26 MCC-27 MCC-28 MCC-35 MCC-36 MCC-37 MCC-39 RC407	*Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland over **Cenchrus ciliaris, Triodia longiceps* and *Cyperus vaginata* low tussock grassland/hummock grassland/sedgeland		**Diagnostic:** *Acacia pyrifolia* agg., *Phyllanthus maderaspatensis, Solanum diversiflorum, Tephrosia rosea* var. *clementii* **Constant:** ***Cenchrus ciliaris, Acacia pyrifolia* agg., *Phyllanthus maderaspatensis, Rhynchosia minima, Eucalyptus victrix, Triodia longiceps, Acacia trachycarpa, Gossypium australe, Euphorbia australis, Evolvulus alsinoides* var. *villosicalyx, Polymeria ambigua, Atalaya hemiglauca, Chrysopogon fallax, Hybanthus aurantiacus, Amaranthus undulatus, Cymbopogon ambiguus, Acacia bivenosa, Corchorus lasiocarpus* subsp. *lasiocarpus, Indigofera monophylla, Tephrosia rosea* var. *clementii, Cleome viscosa, Themeda triandra, Corymbia hamersleyana, Eriachne benthamii* **Dominant:** ***Cenchrus ciliaris, Melaleuca glomerata, Acacia pyrifolia* agg., *Acacia acradenia, Triodia longiceps, Triodia epactia, Acacia tumida* var. *pilbarensis, Eucalyptus victrix, Melaleuca bracteata, Acacia bivenosa, Cyperus vaginatus, Eucalyptus camaldulensis, Eriachne benthamii, Acacia coriacea* subsp. *pendens, Acacia trachycarpa, Themeda triandra, Triodia wiseana, Petalostylis labicheoides, *Aerva javanica, *Cenchrus setiger, Corchorus parviflorus, Corymbia hamersleyana, Pluchea ferdinandi-muelleri, Typha domingensis*

Table 13: Vegetation type extents

Vegetation type	Total extent (ha)	Proportion (%)	Ground-truthed extent (ha)	Extrapolated extent (ha)	Interpolated extent (ha)
AiTw1	893.78	14.76	882.10	11.67	
AiTw2	193.00	3.19	193.00		
AoTl	47.81	0.79	47.59	0.21	
AsTe	31.08	0.51	25.09	5.99	
AsTl	112.00	1.85	112.00		
AtTe	23.57	0.39	23.57		
CcaAiTe	103.37	1.71	103.37		
ChAiTa	155.26	2.56	155.26		
ChAiTe	1,865.06	30.80	1,712.26	152.79	
ChAiTw	57.19	0.94	57.19		
ChAmTe	541.48	8.94	540.23	1.25	
ChApyTt	117.75	1.94	117.75		
EcApyCci	192.64	3.18			192.64
ElAbTe	1,023.49	16.90	1,021.86	1.63	
ElAmTb	42.78	0.71	42.78		
ElAmTe	26.43	0.44	26.43		
ElAptTe	149.00	2.46	149.00		
ElGwTe	86.49	1.43	86.49		
EvApyCci	386.63	6.38	212.70	19.21	154.72
Not Vegetated	7.18	0.12	7.18		
Total	**6,055.99**	**100.00**	**5,515.85**	**192.75**	**347.36**

* The difference between this and the actual total extent (total = 6,055.55 ha) is due to rounding and artefacts of GIS mapping (0.44 ha; 0.007% of total)

4.2.1 GDV (CREEKLINE) VEGETATION

As per the methods detailed in **Section 3.3.3.1**, vegetation characterised by *Eucalyptus camaldulensis* and *Eucalyptus victrix* were used to identify vegetation that may be dependent on groundwater. Two vegetation types were characterised by these species; **EcApyCci** and **EvApyCci**. Taking into consideration depth to groundwater, these vegetation types were further divided into areas where dependence on groundwater was considered likely (less than 10 m) or unlikely (more than 10 m to groundwater). All areas where *Eucalyptus camaldulensis* was recorded as a characteristic species were located in areas where the depth to groundwater was less than 10 m, therefore all of vegetation type **EcApyCci** is likely to be at dependent on groundwater.

The extents of groundwater dependence within the survey area are as shown in **Table 14**.

Table 14: GDV vegetation extents

Vegetation type	Total extent (ha)	Likely to be GDV	Potential GDV	Unlikely to be GDV
EcApyCci	192.64	192.64	-	-
EvApyCci	386.63	-	345.16	41.47
Total	**579.27**	**192.64**	**345.16**	**41.47**

4.2.1.1 Floristic Analysis

OptimClass analysis was run on all (182) quadrats contained within the survey area. OptimClass identified Wards Clustering combined with Chord distance generated on a presence absence transformation produces the most robust and ecologically informative vegetation types (n = 20). Visual assessment of the resulting dendrogram (**Appendix Six**) suggested the presence of three floristic super-groups. One of these super-groups consisted of quadrats located along drainage and required a separate OptimClass analysis. A separate analysis was also conducted on the remaining two supergroups (combined). Analysis of the drainage quadrats suggested that flexible beta (-0.25) Clustering combined with Chord distance generated on a square root transformation produced well defined vegetation types (n = 3). Separate analysis of the supergroups resulted in a more robust and ecologically informative classification scheme for the McPhee creek area.

The floristic analysis dendrograms (**Appendix Six**) for McPhee Creek indicates that there are a total of 19 vegetation types belonging to two super-groups. The vegetation types described and mapped are well supported by clustering in the floristic dendrogram.

4.2.1.2 Vegetation Type Crosswalk

Table 25 in **Appendix Three** shows the Woodman quadrats and their vegetation types, and their Ecoscape equivalent vegetation type.

4.2.1.3 Vegetation Condition

The vegetation of the survey area ranged from Excellent to Poor condition, with the majority in Excellent condition (**Table 15**, **Map 7**). The main factor/s influencing vegetation condition were grazing, historical drill lines/ exploration tracks and the presence of weeds.

The vegetation condition in extrapolated areas was interpreted based on nearby vegetation condition, noting that, unless the area was obviously disturbed or likely to be subject to heavy grazing (generally riparian areas), the condition was likely to be Excellent. The vegetation in interpolated areas (i.e. creeklines) were as interpreted by Woodman (2014b) as is unlikely to have been subject to changes in land use or grazing intensity and thus unlikely to have improved since surveyed.

Table 15: Vegetation condition extents

Vegetation condition	Extent (ha)	Proportion (%)	Ground-truthed extent (ha)	Extrapolated extent (ha)	Interpolated extent (ha)
Excellent	5,207.25	85.99	5,033.59	173.65	-
Very Good	19.53	0.32	-	-	19.53
Good	708.57	11.70	475.09	19.12	214.36
Poor	40.82	0.67	-	-	40.82
Degraded	72.64	1.20	-	-	72.64
Cleared (not vegetated)	7.18	0.12	7.18	-	-
Total	**6,055.99***	**100**	**5515.86**	**192.77**	**347.35**

* The difference between this and the actual total extent (6,055.55 ha) is due to rounding and artefacts of GIS mapping.

4.2.1.4 Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

The species accumulation curve generated using the Pisces Conservation (2010) package (**Figure 5**) indicates that an asymptote has almost been reached, suggesting that the combined floristic surveys over the entire survey area would be unlikely to record many additional species with additional effort and survey effort has been adequate to describe the flora of the survey area. Additionally, the Michaelis-Menten estimate of species richness is 364; including Ecoscape's opportunistic observations the number of recorded species (370) is greater than this estimate, indicating adequacy of survey.

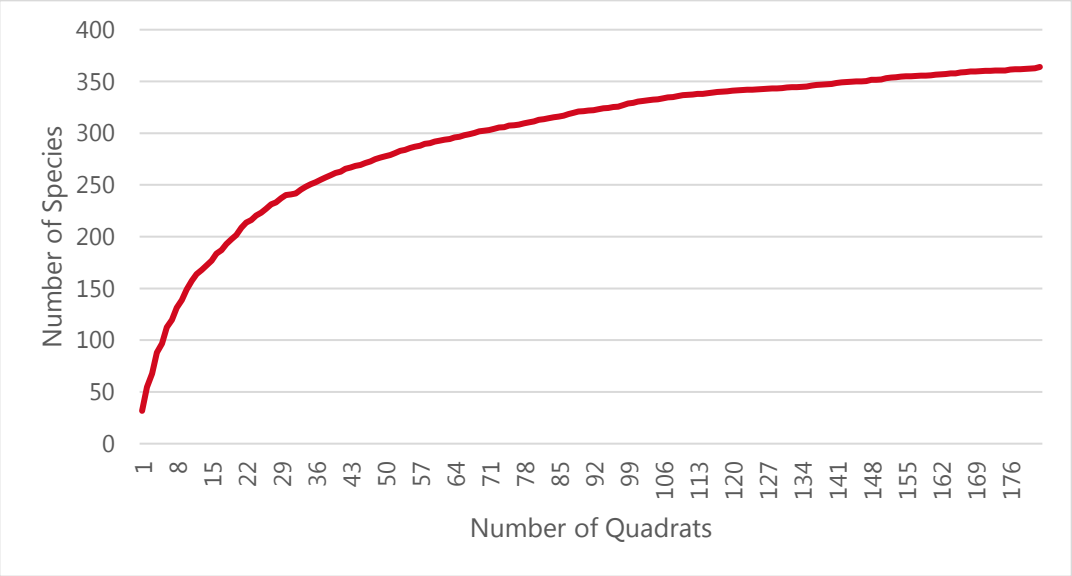


Figure 5: Species accumulation curve using quadrat data (Pisces Conservation Ltd 2010)

The species accumulation curve generated using the vegan R package (Oksanen *et al.* 2007) suggests that additional survey would have recorded only minimal additional species (**Figure 6**). The Woodman (2014c) survey featured a significantly higher (as indicated by the non-overlapping confidence intervals) species richness compared to the Woodman (2019a) and the current survey results; this result is not surprising since the data used extends over a large spatial area (i.e. from the Pilbara coast to McPhee creek) compared to the other surveys.

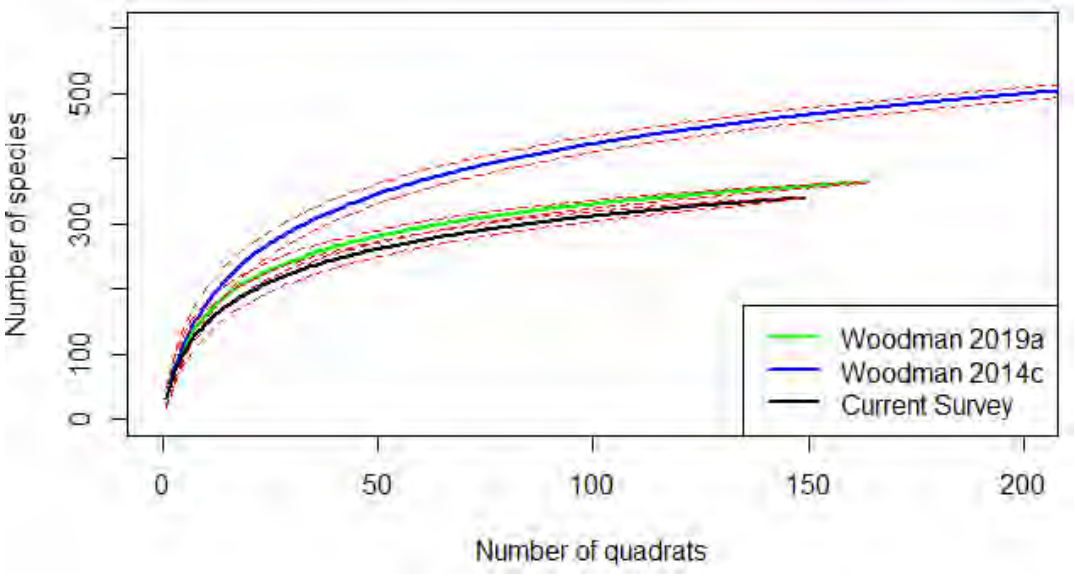


Figure 6: Species accumulation curve using quadrat data. Red dotted lines represent a 95% confidence interval.

4.3 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation-listed flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

Survey type: Detailed flora and vegetation survey with targeted searches for conservation-listed flora searches conducted over one phase. All areas were adequately surveyed using floristic quadrats to sample vegetation types, and targeted searches for conservation-listed flora.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

Survey timing, which was optimal for the bioregion, corresponded with excellent seasonal conditions as a consequence of above average rainfall (**Figure 7**). A full summary of botanical limitations is presented in **Table 16**.

Table 16: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No	The entire area has previously surveyed and mapped with several previous flora and vegetation survey areas intersecting survey area. There have been many other surveys in the nearby surrounding areas. Thus, there is good availability of information to provide local and regional context.
Competency/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The lead botanist conducting the field survey has over 6 years' experience conducting flora and vegetation surveys in Western Australia, including the Pilbara region.

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Proportion of the flora recorded and/or collected, and any identification issues	No	A total of 224 flora taxa were recorded during the 2020 Ecoscape field survey of which a small portion (6.7%) were not identifiable to species and one not identifiable to genus due to lack of reproductive material, most likely due to seasonal conditions rather than survey timing. None are similar to any currently listed TF or PF.
Was the appropriate area fully surveyed (effort and extent)	No (most areas) Moderate (flora: extrapolated areas only) Negligible (interpolated areas)	The majority of the survey area was surveyed adequately to describe the flora, vegetation types and vegetation. The main portion of the survey area had been subject to a number of previous surveys by Woodman, with this survey consolidating and ground-thruthing the previous works and ensuring that the survey effort met current EPA requirements for botanical survey in Western Australia. Sections corresponding with proposed haul roads near the southwest of the survey area were not accessed during the field survey due to asbestos contamination and re-alignment post survey. Vegetation mapping in this section was extrapolated by interpretation of high-resolution aerial imagery. The vegetation in these areas is not complex and interpretation uncomplicated; additionally, there are no conservation-listed vegetation types in the area thus this is considered as only a negligible constraint in regard to vegetation type and condition mapping. However, these parts correspond with, or are close to, locations where conservation-listed flora were recorded. It is not possible to interpret the presence or absence of conservation-listed species in areas that have not been ground-truthed, thus (for flora), there is considered a moderate limitation in extrapolated areas. The creeklines to the southeast of the survey area were not accessed during the 2020 survey, however, they have previously been surveyed and mapped in detail by Woodman. Ecoscape's interpretation is that Woodman's vegetation mapping is an accurate representative of the conditions present, and due to the low likelihood of significant changes since survey, there is a negligible constraint in regard to the botanical survey in this portion of the survey area.
Access restrictions within the survey area	No (most areas) Negligible (interpolated creekline areas; vegetation in extrapolated areas) Moderate (flora in extrapolated area)	Most (ie the main body) of the survey area was fully accessible thus there were no constraints in regard to access in these parts. Sections to the southeast along a proposed haul road were not accessible due to ongoing asbestos reporting (results were not provided at the time of the survey). Additionally, Atlas Iron added a new potential road alignment after the survey had been completed; results for this area have also

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
		been extrapolated. However, the vegetation in this part of the survey area is relatively uncomplicated and there is no vegetation considered as significant, thus negligible constraints in this area. However, conservation-listed flora have potential to occur, thus providing a moderate constraint for flora in regard to access. The creeklines to the southeast of the main survey area were not accessed. However, the previous Woodman mapping was considered an accurate representation of the conditions present thus there is only a negligible constraint in regard to access for the interpolated areas.
Survey timing, rainfall, season of survey	No	The field survey was conducted in April, which is within the optimal season for survey in the Eremaean region of Western Australia. The rainfall in the 4-month period preceding the survey in March was approximately 91% of the long-term mean for the December–March period resulting in average seasonal conditions
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	There were no recent disturbances that would have affected the results of the survey.

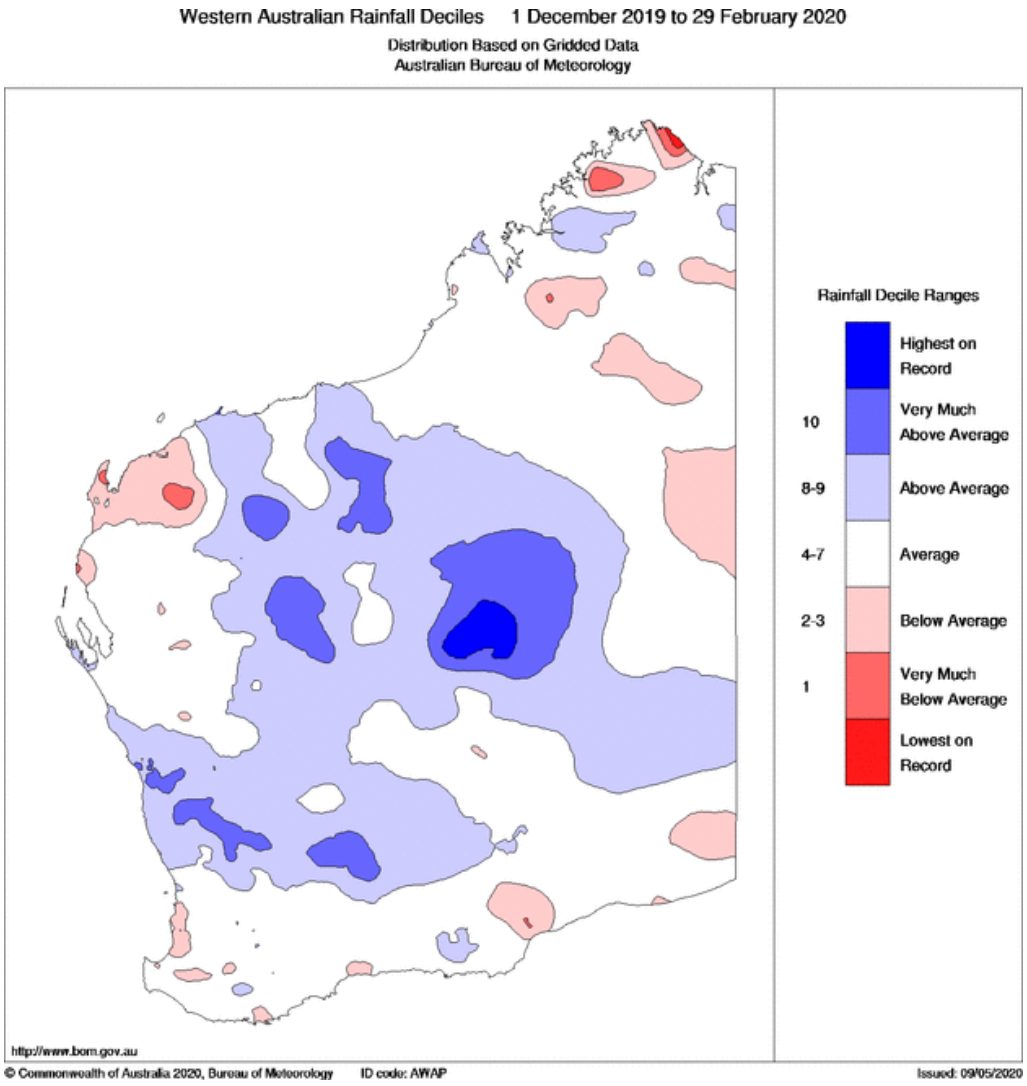


Figure 7: Rainfall percentages for the three months prior to the field survey (BoM 2020b)

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

There were 370 vascular flora taxa recorded from the survey area from 182 floristic quadrats (inclusive of previously established quadrats) and opportunistic searches. Of these, 224 taxa were recorded from Ecoscape's 2020 flora and vegetation survey from 42 newly established floristic quadrats (i.e. this survey). Seven introduced species were detected during the 2020 survey; combined with previously established quadrats there were 16 (4.32%) introduced species indicating that weeds make up only a small portion of the flora inventory.

The species accumulation curve (**Section 4.2.1.4**) indicates that the majority of species are likely to have been recorded from the survey area. The average number of species recorded per quadrat from all data was 33.81 and ranged from 6 to 80 species per quadrat. This species richness is considered commensurate with other flora and vegetation surveys in the bioregion.

The vegetation types with the highest species diversity were vegetation types **AiTw1** (47.11 species), **AsTl** (50.17 species), **ChApyTt** (52.14 species) and **EvApyCci** (47.69 species). The latter two are riparian, being vegetation of minor and medium sized drainage lines (creeklines), however, the species richness of the larger creeklines was less (average 38.00 for vegetation type **EcApyCci**), with weed invasion (Buffel Grass; Birdwood Grass) and more intense grazing as result of the presence of grass and water in associated pools or wallows potentially contributing.

5.1.1 CONSERVATION-LISTED FLORA

5.1.1.1 Threatened Flora

No TF species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded during this survey, nor have any been recorded during any of the previous surveys conducted by Woodman. The database searches indicate that no TF species are known to occur within 50 km of the survey area, therefore, no currently listed TF species are likely to occur.

5.1.1.2 Priority Flora Recorded During 2020

Three PF were recorded from the survey area during 2020: one P1 (*Acacia aphanoclada*), one P3 (*Rostellularia adscendens* var. *latifolia*), and one P4 (*Ptilotus mollis*).

Acacia aphanoclada

P1 species are considered poorly known and are known from few locations which are potentially at risk (DBCA 2019). *Acacia aphanoclada* was the only P1 species located within the survey area. It is known from 44 records in Western Australia all from within the Chichester IBRA subregion (DBCA 2007-2020). This taxon is likely to be locally common within the **ChAiTe** vegetation type located on pebble conglomerate, sandstone, siltstone, and minor layered chert and thin-bedded felsic tuff with interlayered ultramafic rocks (metamorphosed) located 6 km southwest of the McPhee camp along the haul road. The total extent of *Acacia aphanoclada* is indicated on *NatureMap* (DBCA 2007-2020) as occupying approximately 65 km east-west and 40 km north-south, although most of the 46 records for this species are to the south of the McPhee Creek population. There are two loci within the McPhee Creek survey area representing two populations.

The southern population along the potential haul road, indicated on **Map 5H**, had over 2,000 individual *Acacia aphanoclada* recorded, with the population also extending outside of the area surveyed (noting that, due to

access restrictions due to asbestos and further areas added after completion of the field survey, some parts could not be surveyed; these are in the extrapolated survey area). It would be unlikely that clearing for a haul road, regardless of where it gets located within the general vicinity of the area subject to this survey, would have a significant regional impact on the population of this species and only a low local impact with likely less than 10% of the local population affected, and likely even less if the road is located on the westernmost option.

Woodman (2019c) only recorded a single individual in the northern population in the main body of the survey area, which is located within the proposed disturbance footprint. Impacts on this population would be high, with complete removal, however, on a regional scale the impact from removing a single individual would be insignificant (low). Occasional individuals were also recorded along the creeklines; no clearing is proposed along the creeklines, however, it is not possible determine the effect of indirect impacts on these individuals, although significant impacts on the species as a whole would be likely to be insignificant (low).

Rostellularia adscendens* var. *latifolia

P3 species are considered poorly known and in need of further survey but are not currently under threat (DBCA 2019). As such, and based on the known distribution, the P3 species in the survey area (*Rostellularia adscendens* var. *latifolia*) is unlikely to be considered currently under threat and the potential impact is considered negligible. Woodman (2014a; 2019c), when considering the likely impacts on this species due to hydrological change, also considered the potential impact negligible.

Ptilotus mollis

P4 species are rare but present on conservation lands, near threatened but have been adequately surveyed and are not considered to be currently threatened, or are otherwise in need of monitoring (DBCA 2019). As such, P4 species are not currently under threat and any potential impact is considered negligible.

Woodman (2019c) has recorded over 6,000 individuals from the area (Ecoscape recorded only four individuals); as this species has an east-west distribution of over 650 km, any regional impacts of removing local populations are likely to be insignificant (low).

5.1.1.3 Other Conservation-listed Flora

There are two PF taxa (*Eragrostis crateriformis* and *Goodenia nuda*) that have been previously recorded from the survey area that was not recorded during the 2020 survey. Of these, the previous recording of *Eragrostis crateriformis* (P3) is considered likely to be accurate as it is represented by vouchered herbarium specimens and, although not recorded during 2020 it may be present in low numbers despite not being detected during searches in previously recorded locations. However, the *Goodenia nuda* record is unconfirmed (i.e. there is no vouchered specimen, and Woodman (2019a) indicates it as a possible mis-identification) and unlikely as the habitat it was recorded from is not its usual habitat (see **Section 4.1.3.1**). *Goodenia nuda* has an extensive range within the Pilbara and other bioregions, occurring primarily on moist depressions, claypans, edge of drainage lines and floodplains, and does not occur in habitats that might be considered as locally restricted.

Barring *Eragrostis crateriformis* and *Goodenia nuda*, no additional conservation-listed flora species that were identified by the database searches from nearby were considered a High likelihood of occurring within the survey area based on their known distribution, habitat as described on *FloraBase* and in specimen records (WAH 1998-2020; 2020), having potentially suitable habitat available within the survey area or been detected by the any previous detailed surveys conducted on the survey area (i.e. previous survey effort; see **Section 4.1.3.2**).

5.1.2 INTRODUCED FLORA

Seven introduced flora were recorded during the 2020 field survey. One of the introduced flora species, **Calotropis procera*, is a Declared Pest plant and was found amongst a rocky outcrop in the central survey area. *Calotropis procera* is in the Exempt category and has no management requirements in regard to its presence. The remaining six introduced taxa recorded in 2020 (**Aerva javanica*, **Cenchrus ciliaris*, **Cenchrus setiger*, **Cynodon dactylon*, **Echinochloa colona*, **Malvastrum americanum*) are ranked as having High ecological impact and rapid invasiveness for the Pilbara Region (DPaW 2013).

Additional to those recorded during the 2020 survey, Woodman (2019a) has also recorded **Argemone ochroleuca*, **Chloris barbata*, **Citrullus amarus*, **Euphorbia hirta*, **Flaveria trinervia*, **Portulaca pilosa*, **Setaria verticillata*, **Sonchus oleraceus* and **Vachellia farnesiana*. None are unusual occurrences in the Pilbara although **Euphorbia hirta* is more common in the Kimberley, and none are Declared Pest plants or WoNS species.

No introduced flora have any management requirements under the BAM Act.

5.2 VEGETATION SIGNIFICANCE

Nineteen consolidated vegetation types were recorded as occurring in the survey area, corresponding with three major landforms:

- predominantly hillcrests/hillslopes: **AiTw2**, **AiTw1, CcaAiTe**, **ChAiTe**, **ChAiTa**, **ChAiTw**, **ElAbTe**, **ElAptTe**, **ElAmTb**, **ElAmTe**, **ElGwTe**
- stony plains: **AoTl**, **AsTe**, **AsTl**, **AtTe**
- predominantly drainage lines: **ChAmTe**, **ChApyTt**, **EcApyCci**, **EvApyCci**.

5.2.1 SIGNIFICANT ECOLOGICAL COMMUNITIES

No vegetation was considered to represent any current Western Australian-listed or Commonwealth EPBC Act-listed TEC within the survey area. None are known from the vicinity.

The DBCA database search identified areas mapped as the *Stony saline clay plains of the Mosquito Land System* PEC approximately 4 km west of the main body of the survey area, intersecting with the creeklines portion of the survey area near Nullagine River (23.18 ha, representing 0.38% of the survey area). The Land System defining the PEC occupies 8,134.63 ha in total, therefore the intersecting portion within the survey area represents 0.003% of the total extent, based on Land System mapping (DPIRD 2018b). However, the vegetation within the survey area is not similar to the characteristic vegetation of the PEC, which is a *Triodia longiceps* perennial grassland with scattered *Maireana melanocoma*, *Sclerolaena* spp., *Melaleuca eleuterostachya* and *Acacia bivenosa* (Species and Communities Program, DBCA 2020). Therefore, despite intersecting with the definitive Land System, it is unlikely that the PEC occurs within the survey area.

5.2.2 OTHER SIGNIFICANT VEGETATION

Based on the criteria provided in the Flora and Vegetation Technical Guidance (EPA 2016c), a number of vegetation types may be considered as significant (restricted distribution, history of impact, role as a refuge, function in maintaining ecological integrity). These are discussed below.

5.2.2.1 Restricted Distribution

The following vegetation types have extents of less than 1% of the McPhee Creek survey area and may be considered as spatially restricted vegetation types:

- **AoTl** (47.81 ha, 0.79%)
- **AsTe** (31.08 ha, 0.51%)
- **AtTe** (23.57 ha, 0.39%)
- **ChAiTe** (57.19 ha, 0.94%)
- **ElAmTb** (42.78 ha, 0.71%)
- **ElAmTe** (26.43 ha, 0.44%).

While vegetation type interpretation and mapping, and therefore extents within a survey area, are open to interpretation, small extents, particularly if they are associated with an uncommon landform or meet a particular defining attribute as listed in the Flora and Vegetation Technical Guidance (EPA 2016c) may be significant.

None of those listed above meet any of the other requirements listed in the Flora and Vegetation Technical Guidance to be considered as significant, except as a result of their small extents.

Ecoscape does not consider any of the vegetation types within the survey area to have any particular significance

5.2.3 GROUNDWATER DEPENDENT VEGETATION

Woodman (2019a), when taking into consideration hydrological information as well as indicator plant physiology, only considered one of its vegetation types, characterised by *Eucalyptus camaldulensis*, to likely represent a GDV, and then only in localised areas as the characteristic species may be a facultative phreatophyte in some areas and circumstances. Ecoscape's research indicates that *Eucalyptus camaldulensis sens. lat.* is (in most circumstances) considered to be an obligate phreatophyte, and therefore vegetation with this species included is likely to be representative of a GDV (Eamus *et al.* 2006; Grierson 2010).

Traverses within the main body of the survey area did not detect *Eucalyptus camaldulensis sens. lat.* within any of the drainage lines, including along the haul road, therefore we have concluded that no GDV corresponds with the majority of the survey area.

The creeklines to the southeast of the main body of the survey area were not ground-truthed. Ground-truthing Woodman's vegetation mapping in other parts was considered to be an accurate representation of the vegetation present, although mapped in more detail than required. Due to the accuracy of Woodman's vegetation mapping, against which Ecoscape has cross-referenced quadrat data to confirm and incorporated depth to groundwater, we do not consider that there are any significant constraints in regard to not having ground-truthed the mapping (see **Table 16** in **Section 4.3**). The vegetation types along the creeklines are considered to be interpolated.

A total of 579 ha has been considered to possibly represent GDV.

Woodman's vegetation type 15 (see **Table 8** in **Section 2.5.1.4**), which Woodman (2019a) considered to be a 'likely GDV' has, as a result of cross-referencing species within quadrats, been divided into the two riparian vegetation types within the survey area, most in **EcApyCc**i and a smaller extent in **EvApyCci**. All of vegetation type **EcApyCci** is located in parts where the depth to groundwater is less than 10 m, therefore this vegetation type, which occupies 192.64 ha, is considered likely to represent a GDV type.

Woodman's vegetation types 13 and 14 have, except where *Eucalyptus camaldulensis* occurred within the quadrats (now in vegetation type **EcApyCci**) have been incorporated into vegetation type **EvApyCci**. Woodman's vegetation type 7, where *Eucalyptus victrix* was a component, has also been incorporated into this vegetation type. **EvApyCci** occupies 386.63 ha. Where the depth to groundwater is less than 10 m and it is possible that *Eucalyptus victrix* can access the groundwater, this vegetation type is considered as a potential GDV (345.16 ha). Where the depth to groundwater is more than 10 m and *Eucalyptus victrix* is unlikely to be able to access groundwater, this vegetation type is considered unlikely to be GDV.

The **Map 6** series and GIS data should be viewed for locations of likely, potential GDVs and riparian (creekline) vegetation unlikely to be GDV.

Vegetation types **EcApyCci** and **EvApyCci** also include *Atalaya hemiglauca*, *Melaleuca glomerata* and *Sesbania cannabina* that potentially rely on the continual access to groundwater and are commonly considered as ecological indicators for groundwater dependence (Batini 2009; Eamus 2009a; EPA & Hamersley Iron Pty Ltd 2010; Equinox Environmental 2017; Resource and Environmental Management Pty Ltd 2007). However, taking into consideration their low density and only occasional occurrence, as well as depth to groundwater in the survey area, herein they are more likely to be facultative phreatophytes and therefore an indicator of potential GDV.

5.2.4 EXTRAPOLATED VEGETATION TYPE ASSESSMENT AND MAPPING

Prior to fieldwork commencing Atlas Iron included an area along an existing track and a proposed alternative route for a potential haul road in the southwest of survey area. Part of the existing track could not be accessed during the field survey due to asbestos contamination, however, with adequate safety precautions the proposed alternative route was surveyed. After the field survey Atlas Iron added another potential haul road route. The vegetation types and condition along the inaccessible part of the survey area and the most recently added route have been extrapolated from the nearby area that was ground-truthed, using aerial imagery interpretation (**Map 6H**). Whilst the level of detail for vegetation types is likely to be less than if the area had been ground-truthed, there is no reason to consider that the vegetation in these areas would be significantly different to nearby, and none is likely to have any conservation significance or other significance according to the Flora and Vegetation Technical Guidance (EPA 2016c).

However, the proposed haul road intersects over 2,000 individual *Acacia aphanoclada* (P1) individuals (**Map 5H**). It is not possible to determine if or where individuals are located nor make an estimate of population in unsurveyed areas. Field observations suggest that the recorded population is likely to extend to the east of the mapped population, and less likely to extent to the west.

5.3 VEGETATION CONDITION

The vegetation of McPhee Creek ranged from Excellent to Degraded condition. Most (86%) of the survey area was recorded to be in Excellent condition with negligible evidence of disturbance. The Degraded condition vegetation was from the interpolated creeklines, and was assessed as this condition category by Woodman over various surveys (Woodman 2014b; 2019a) due to grazing, trampling/soil disturbance and weed invasion, primarily by **Cenchrus ciliaris* (Buffel Grass) and **Aerva javanica* (Kapok).

6 CONCLUSIONS

6.1 FLORA AND VEGETATION FACTOR CONSIDERATIONS

Considerations for EIA for the factor *Flora and Vegetation* (EPA 2016a) include, but are not necessarily limited to:

- application of the mitigation hierarchy to avoid and minimise impacts to flora and vegetation, where possible
- the flora and vegetation affected by the proposal
- the potential impacts and the activities that will cause them, including direct and indirect impacts
- the implications of cumulative impacts
- whether surveys and analyses have been undertaken to a standard consistent with guidance
- the scale at which impacts to flora and vegetation are considered
- the significance of the flora and vegetation, and the risk to the flora and vegetation
- the current state of knowledge of flora and vegetation and the level of confidence underpinning the predicted residual impacts
- whether proposed management and mitigation approaches are technically and practically feasible
- whether the proposal area will be revegetated in a manner that promotes biological diversity and ecological integrity.

Various issues are frequently of significance within the environmental impact assessment process. These issues, and the potential impact from the proposed works, are summarised below.

6.1.1 HABITAT LOSS, DEGRADATION AND FRAGMENTATION

The two pre-European vegetation association associated with the survey area have more than 99% of the original extent remaining. The small scale of clearing for mining within these tenements is unlikely to have a significant effect on the pre-European vegetation association extent.

While degradation of the survey area will undoubtedly occur with the proposed mining development within the survey area, the scale of degradation is unlikely to be significant. Due to the large remaining extents, fragmentation is unlikely to be a significant issue for the vegetation. None of the vegetation types recorded are of conservation significance.

6.1.2 INVASIVE SPECIES

Seven introduced species were recorded from the survey area tenements; one is a Declared Pest plant (**Calotropis procera*), none are WONS species.

Buffel Grass (**Cenchrus ciliaris*), introduced as pastoral species, has significantly affected vegetation condition, mainly in riparian vegetation types. The presence and impact of this species is not a result of mining activities, and mining is unlikely to significantly increase the impact.

Other introduced species currently occur sporadically and are having little effect on vegetation condition (with the exception of the single location of **Calotropis procera*). Whilst mining activities may increase their extent, density and impact it is possible, with management, to minimise these effects.

6.1.3 FIRE REGIMES

Fire occurs naturally in the landscape as a result of lightning strike and vegetation has evolved to recover rapidly. Fire has also been used by Traditional Owners to flush game and generate new growth that attracts herbivores and has been used by pastoralists to generate new growth that is more palatable to livestock.

Any proposed mining activities are unlikely to alter the frequency, intensity or extent of fires.

6.1.4 CHANGING CLIMATE

Climate change in the adjacent Pilbara region of Western Australia is likely to increased frequency and intensity of cyclones and be responsible for increases in temperature (Western Australian Government 2012). No specific information is available for the Gascoyne bioregion, particularly the interior parts, however, the Department of Primary Industries and Regional Development (DPIRD) anticipate that rainfall in the interior Pilbara is expected to increase and, with rising temperatures, evapotranspiration will increase (DPIRD 2019). There is no information available regarding the scale of these changes, or if the anticipated increase in rainfall will be greater than evapotranspiration, or the seasonality of such changes.

Climate change impacts on native flora and vegetation may be of importance as a cumulative impact when taking all changing factors into account, however, on its own, climate change is unlikely to be to be a significant factor in the survey areas.

6.1.5 STATE OF KNOWLEDGE

It is unlikely that any knowledge gaps relating to the vegetation of the survey areas are likely to be of significance.

It is considered the 'application of general ecological principles' are likely to be a reasonable guide to understanding the flora and vegetation of the survey area.

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MAPS

816000 818000 820000 822000 824000 826000 828000 830000 832000 834000 836000 838000

7614000 7612000 7610000 7608000 7606000 7604000 7602000 7600000 7598000 7596000 7594000

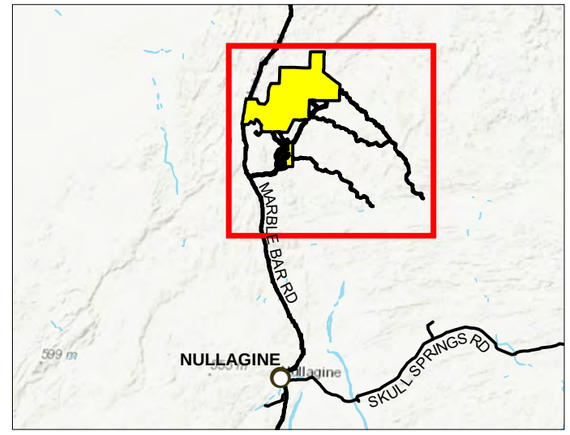
LEGEND
McPhee Creek Survey

280Ty
280Ro
280Cp
280Rk
280Tl
280Gr
280Ri
280Mo
MARBLE BAR RD

LEGEND

Soil Landscape Systems (DPIRD, 2018)

- 280Cp: Capricorn System – rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.
- 280Gr: Granitic System – rugged granitic hills supporting shrubby hard and soft spinifex grasslands.
- 280Mo: Mosquito System – stony plains and prominent ridges of schist and other metamorphic rocks supporting shrubby hard spinifex grasslands.
- 280Ri: River System – narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.
- 280Rk: Rocklea System – basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.
- 280Ro: Robe System – low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.
- 280Tl: Talga System – hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.
- 280Ty: Taylor System – stony plains and isolated low hills of sedimentary rocks supporting hard and soft spinifex shrubby grasslands.



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

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SOIL LANDSCAPE SYSTEMS

MCPHEE CREEK
FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

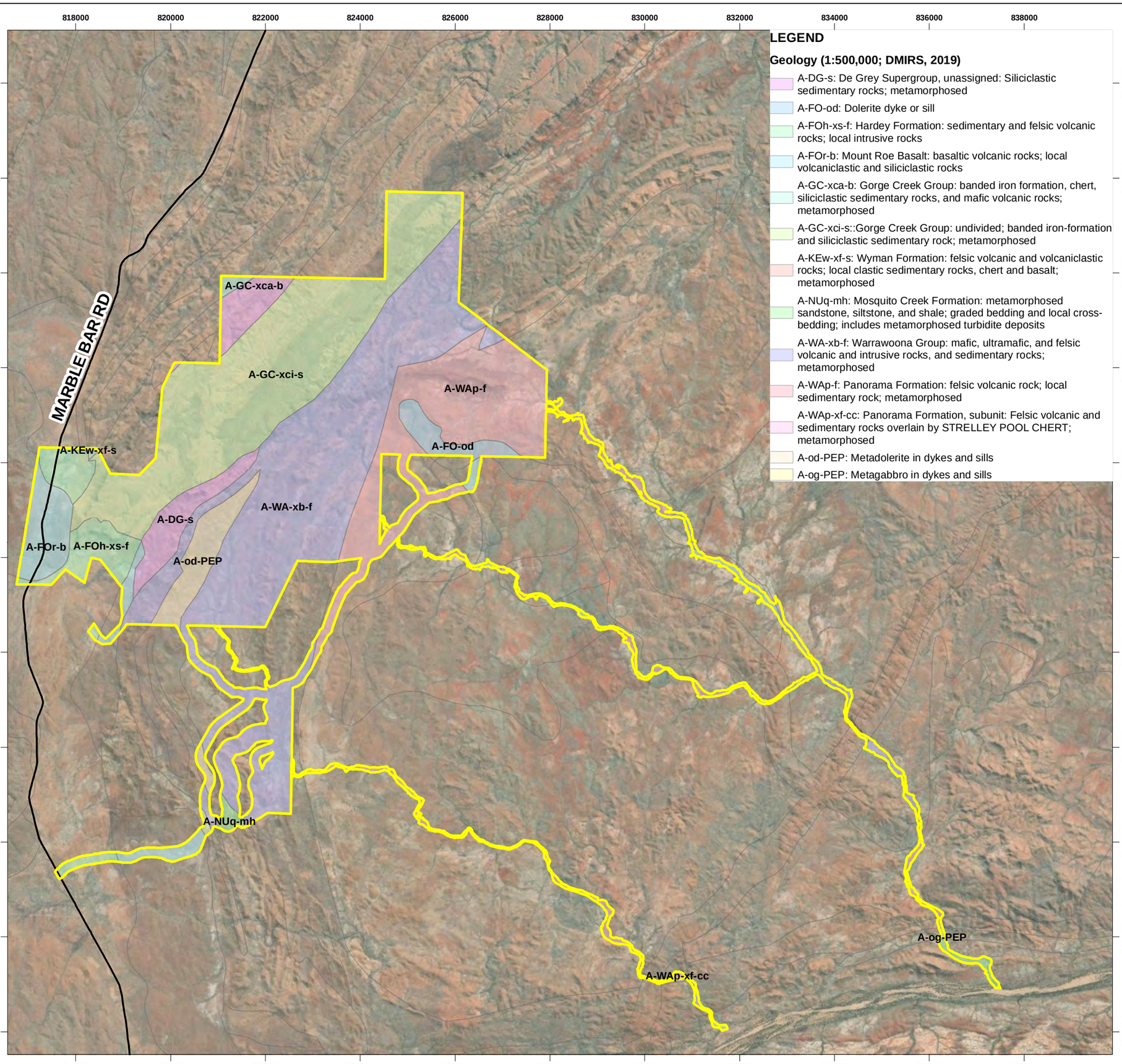
SCALE: 1:80,000 @ A3

0 1.5 3 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	10/07/2020

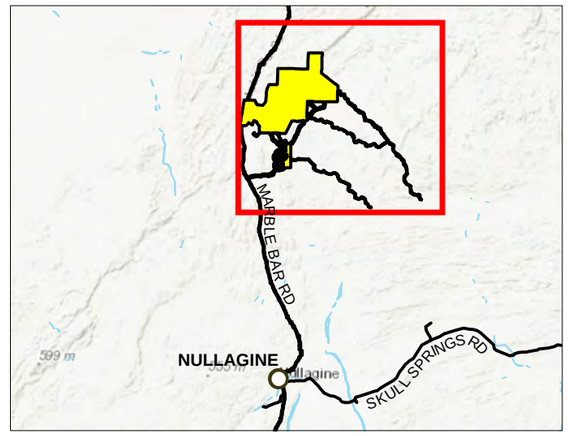
MAP
1



LEGEND

McPhee Creek Survey Area

*Surface Geology legend only shows units intersecting with the Survey Area



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SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

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GEOLOGY

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:80,000 @ A3

0 1.5 3 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	10/07/2020

MAP 2

816000 818000 820000 822000 824000 826000 828000 830000 832000 834000 836000 838000

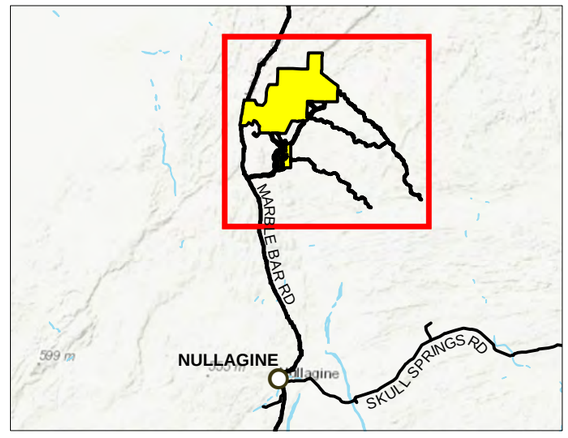
7614000 7612000 7610000 7608000 7606000 7604000 7602000 7600000 7598000 7596000 7594000

LEGEND

McPhee Creek Survey Area

Pre European Vegetation (DPRID, 2018)

- 171: Hummock grasslands, low tree steppe, snappy gum over soft spinifex and *Triodia brizioides*
- 173: Hummock grasslands, shrub steppe, kanji over soft spinifex and *Triodia wiseana* on basalt
- 190: Hummock grasslands, sparse shrub steppe; *Acacia bivenosa* and *A. trachycarpa* over hard spinifex, *Triodia wiseana*, Very poor rocky country on gneiss



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

PRE EUROPEAN VEGETATION

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:80,000 @ A3

0 1.5 3 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 3

814000 816000 818000 820000 822000 824000 826000 828000 830000 832000 834000 836000 838000

7618000 7616000 7614000 7612000 7610000 7608000 7606000 7604000 7602000 7600000 7598000 7596000

MARBLE BAR RD

Pmo Ecr Gnu Aap Radl Ths Fsg

NULLAGINE

SKULL SPRINGS RD

599 m

LEGEND

McPhee Creek Survey Area

Conservation-listed flora (Atlas Iron & DBCA, 2020)

- Priority 1
- Priority 3
- Priority 4

Threatened and Priority Ecological Communities (DBCA, 2020)

Stony saline clay plains of the Mosquito Land System

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

ATLAS AND DBCA DATABASE RESULTS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

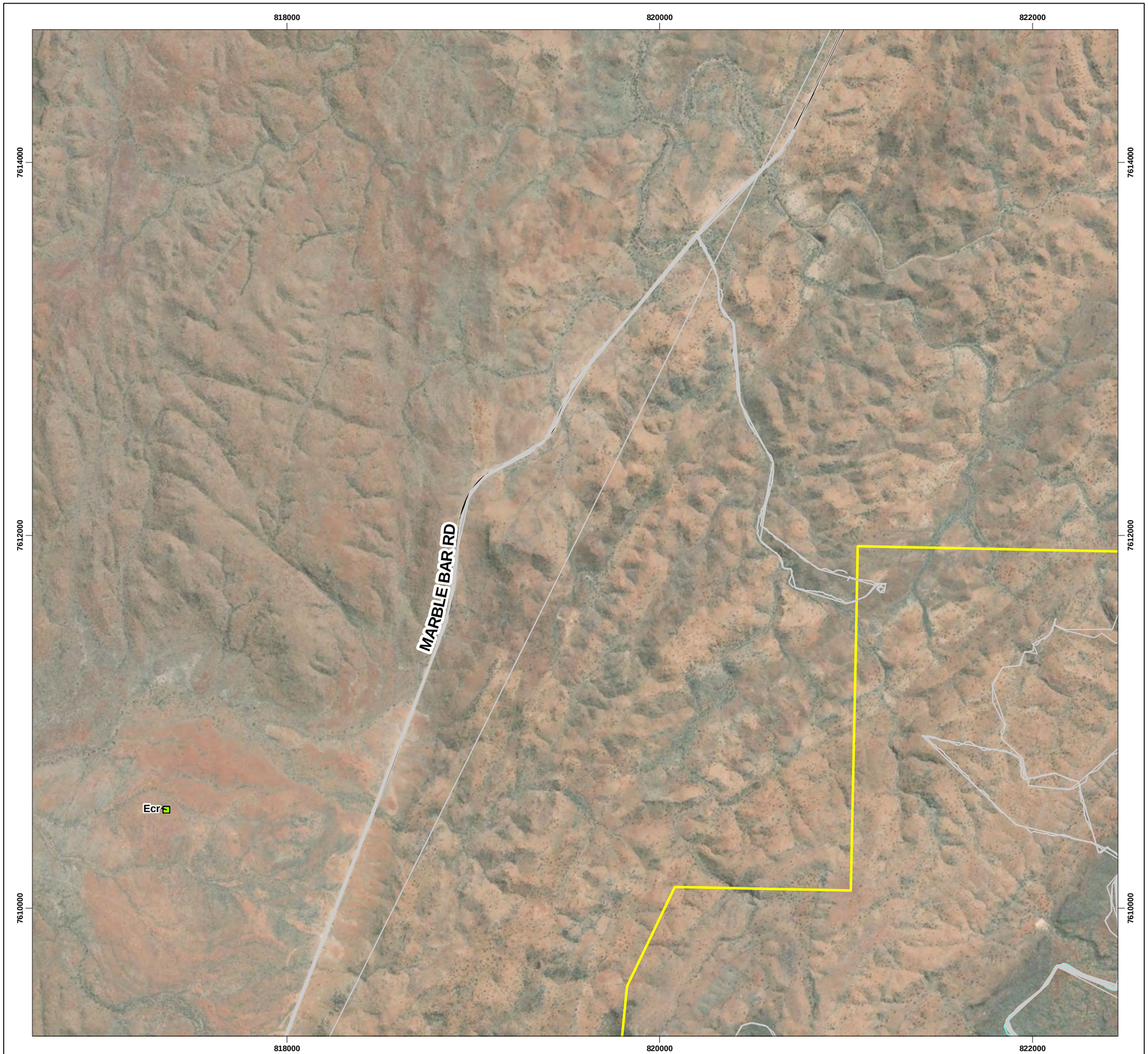
SCALE: 1:90,000 @ A3

0 1.5 3 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 4



LEGEND

McPhee Creek Survey Area

Survey Tracks

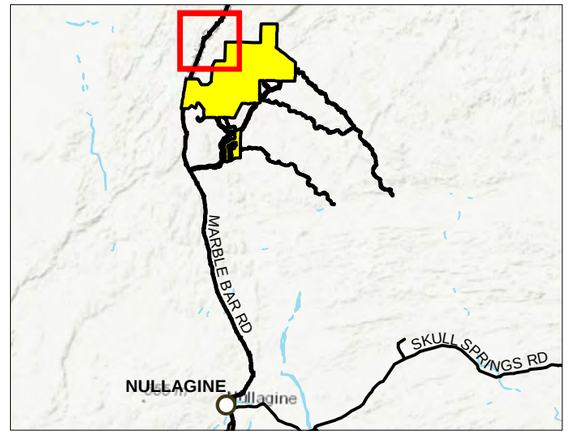
Ecoscape (2020)

Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

Priority 3

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



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CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5A

824000
826000
828000
7614000
7612000
7610000

Pmo
Ecr
Aap

LEGEND

McPhee Creek Survey Area

Survey Tracks

Ecoscape (2020)

Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

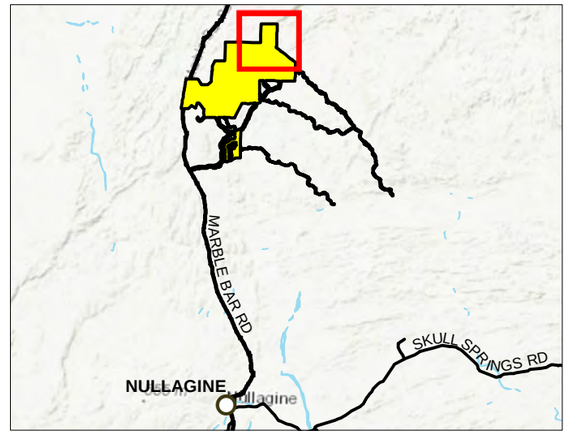
Priority 3

Priority 4

Phase 1 (Ecoscape, 2020)

Priority 4

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

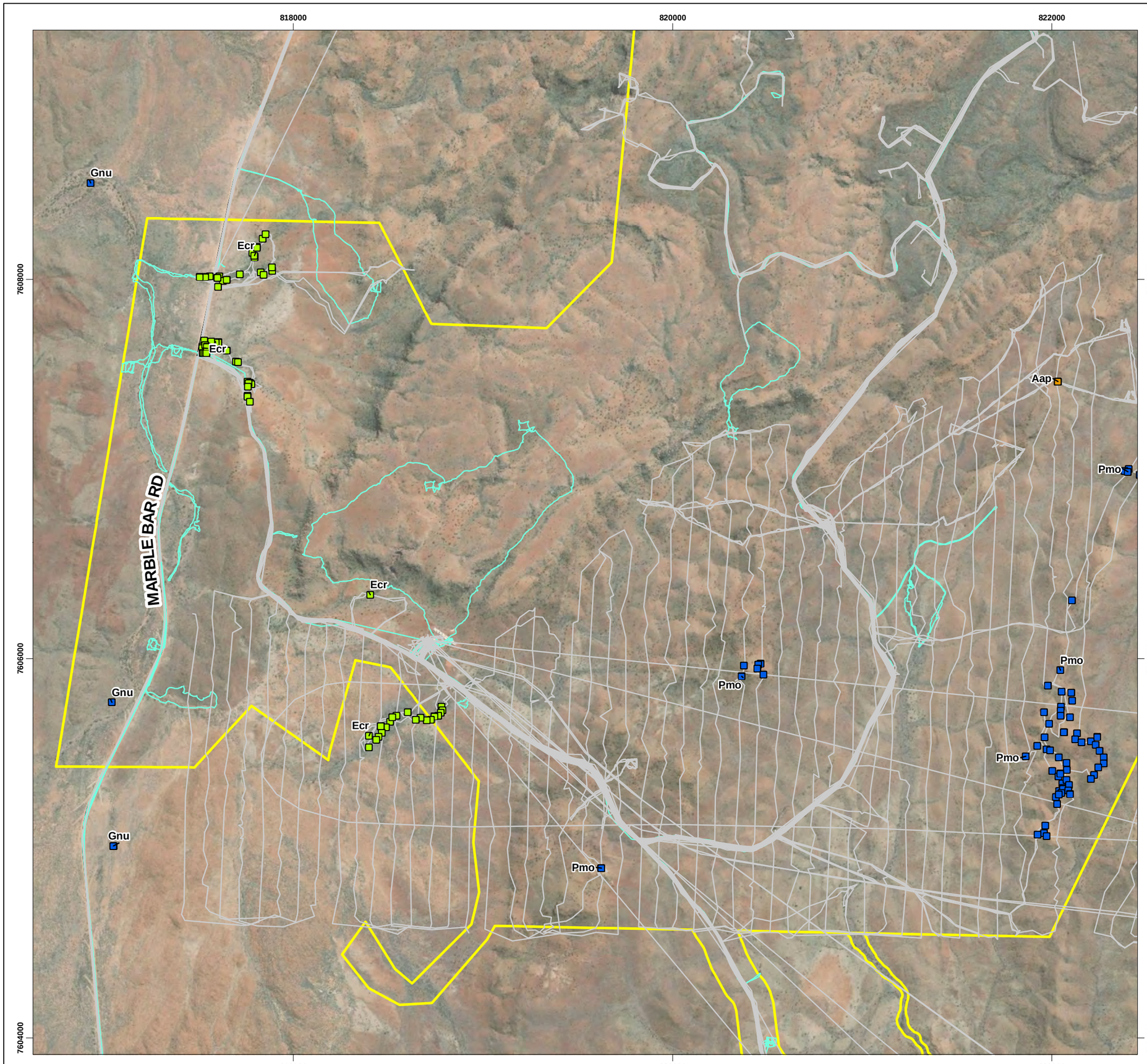
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5B



LEGEND

McPhee Creek Survey Area

Survey Tracks

Ecoscape (2020)

Woodman (2014c)

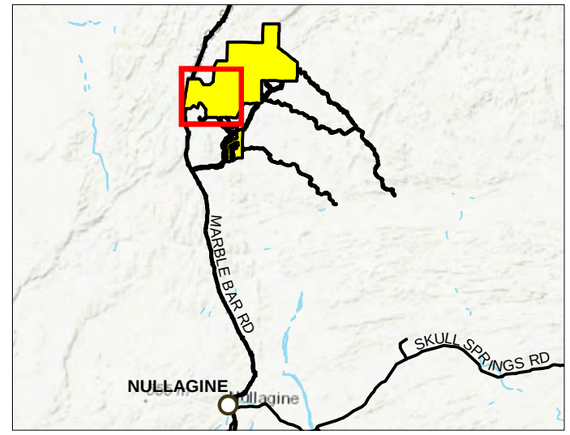
Previous Surveys (Atlas Iron & DBCA, 2020)

Priority 1

Priority 3

Priority 4

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5C

824000
826000
828000
7608000
7606000
7604000

Pmo
Pmo
Ecr
Pmo
Pmo
Radl
Radl
Ecr
Radl

LEGEND

McPhee Creek Survey Area

Survey Tracks

Ecoscape (2020)

Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

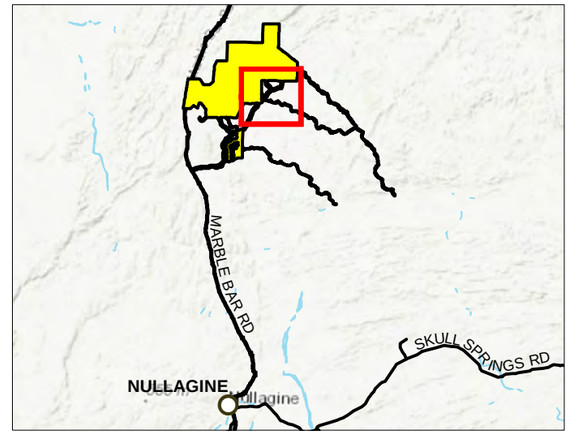
Priority 3

Priority 4

Phase 1 (Ecoscape, 2020)

Priority 3

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

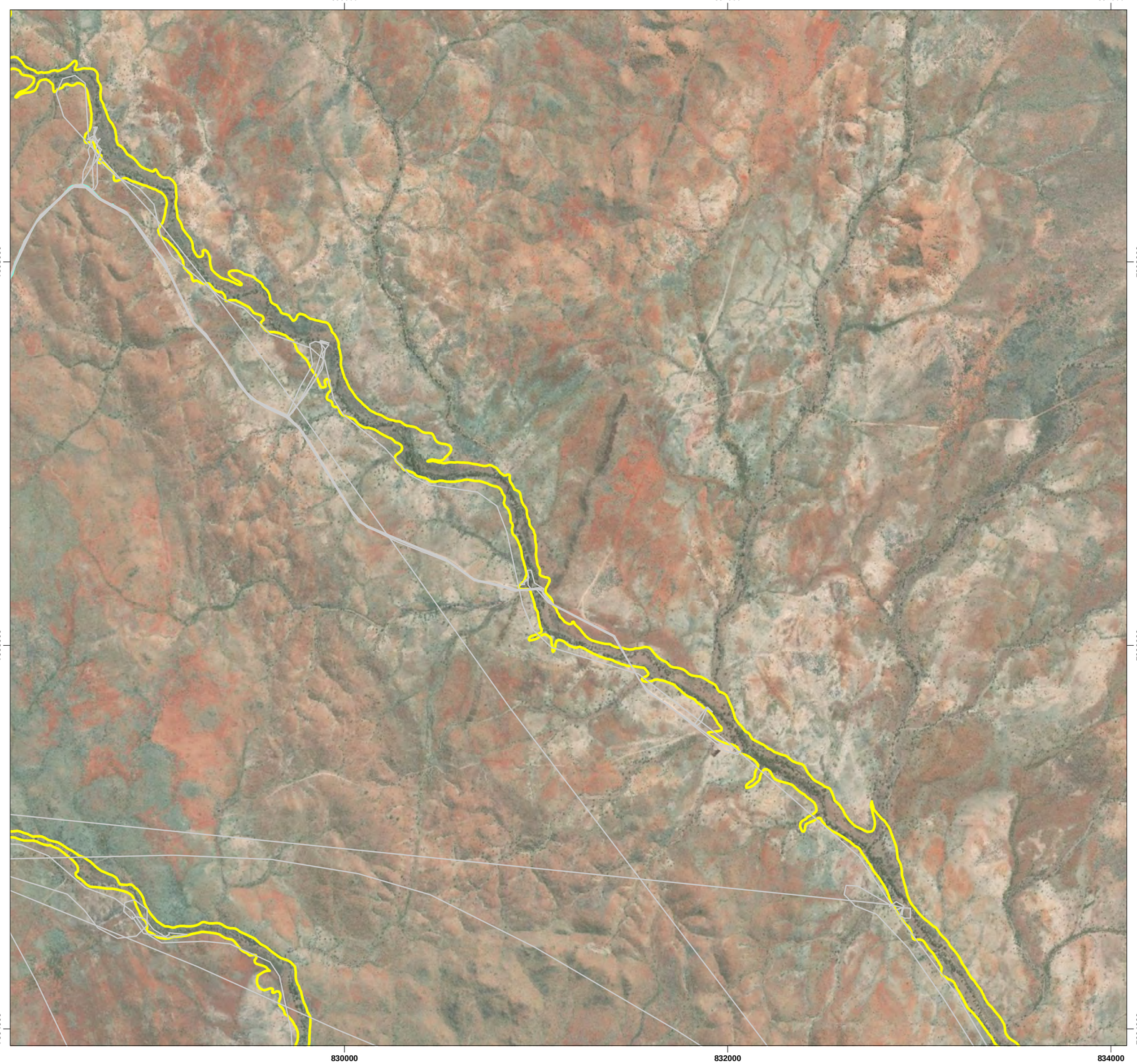
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5D



LEGEND

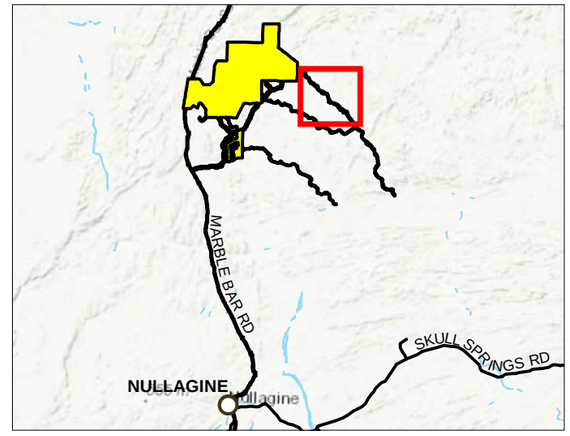
McPhee Creek Survey Area

Survey Tracks

Ecoscape (2020)

Woodman (2014c)

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5E

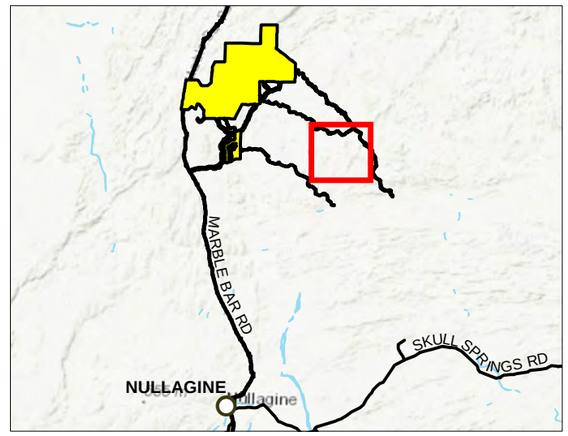
LEGEND

- McPhee Creek Survey Area
- Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

- Priority 1
- Priority 3

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

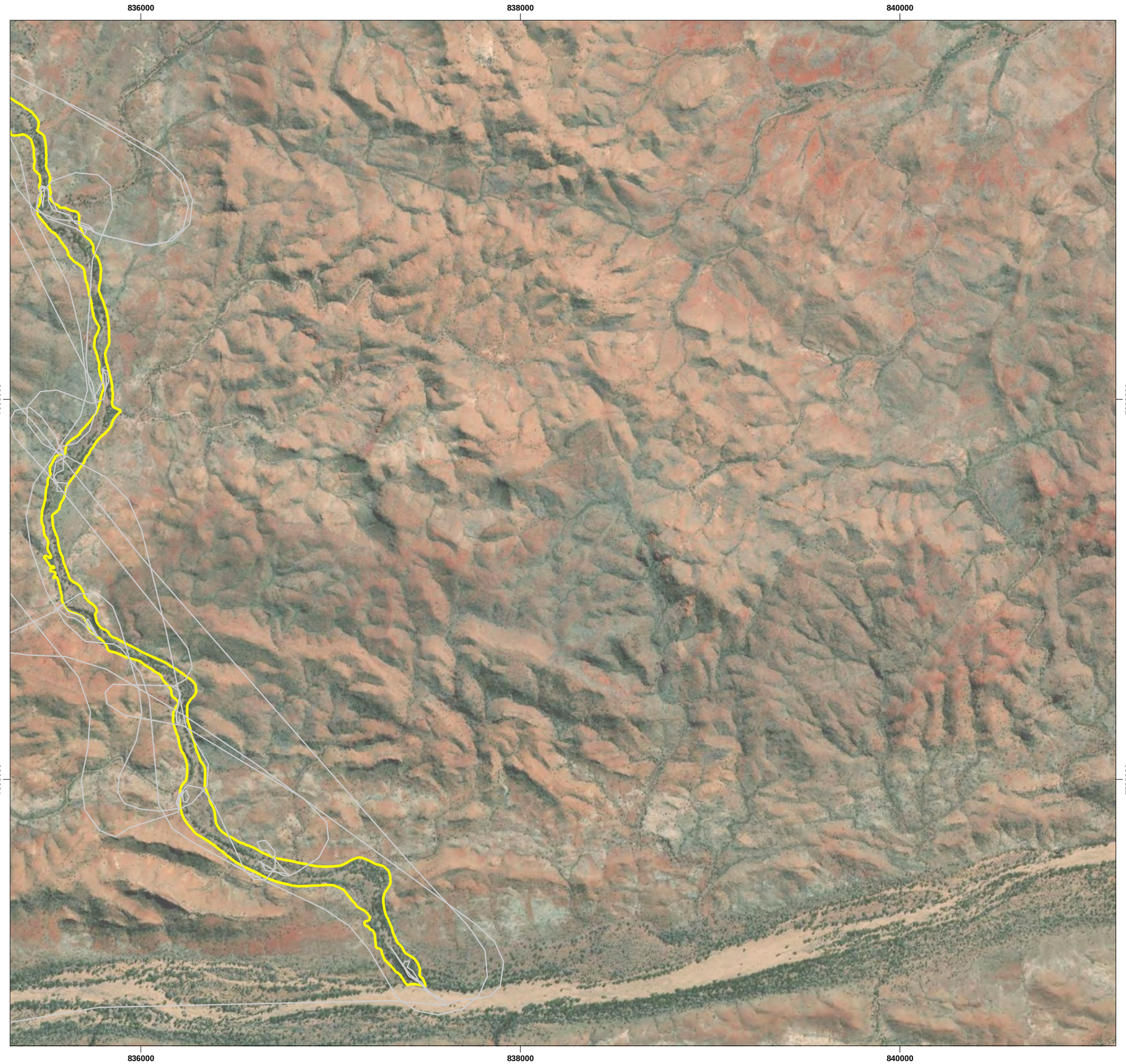
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5F

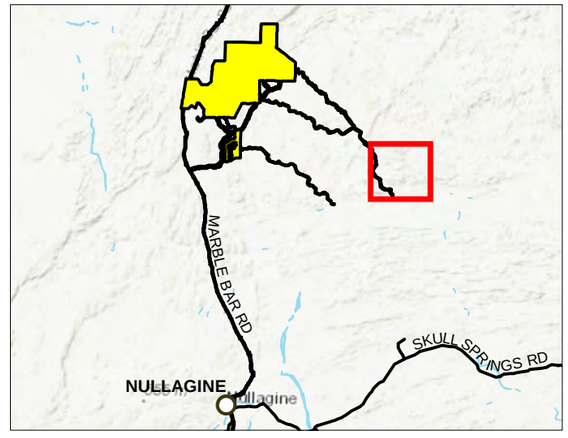


LEGEND

McPhee Creek Survey Area

Woodman (2014c)

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

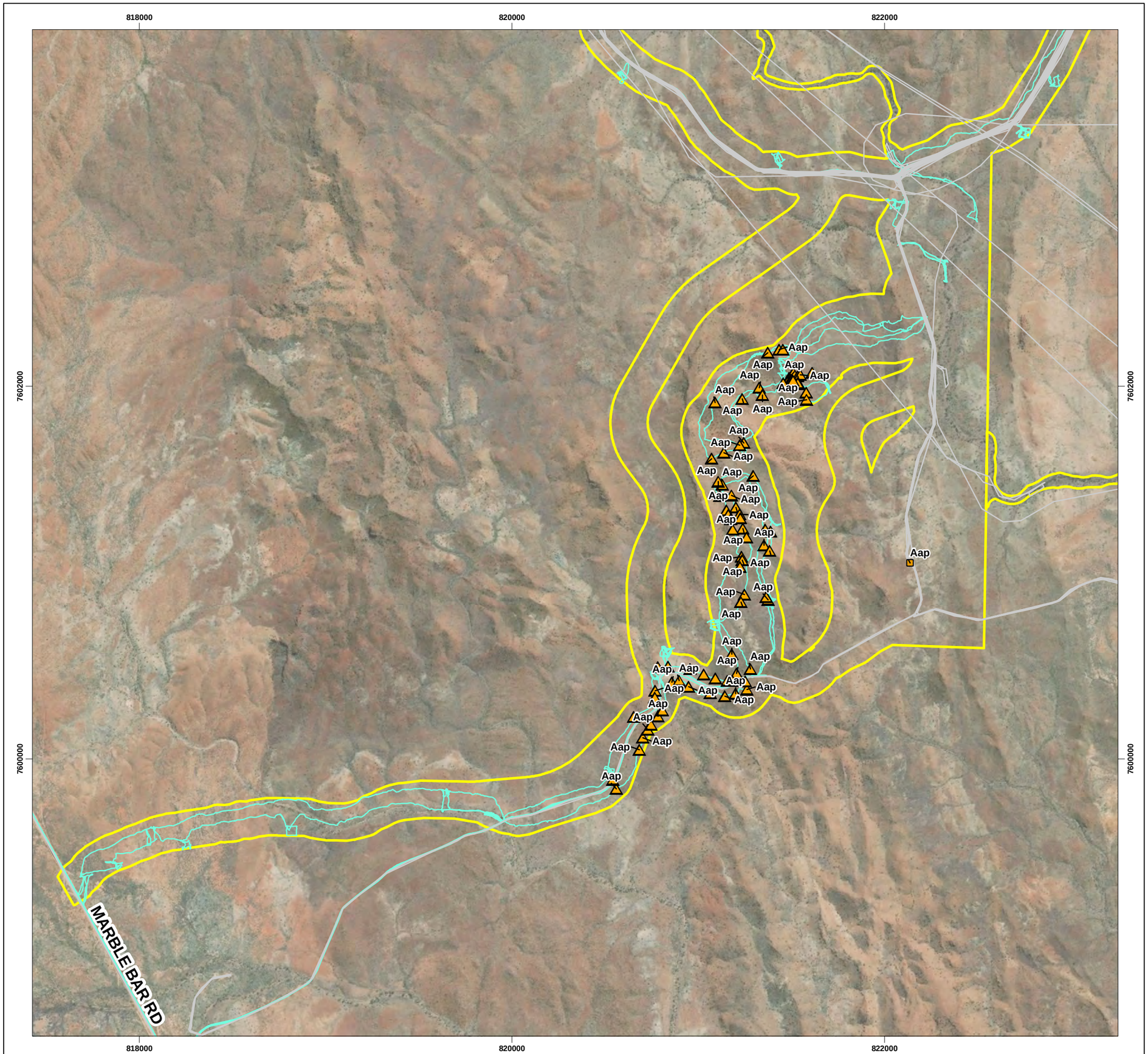
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5G



LEGEND

McPhee Creek Survey Area

Survey Tracks

Ecoscape (2020)

Woodman (2014c)

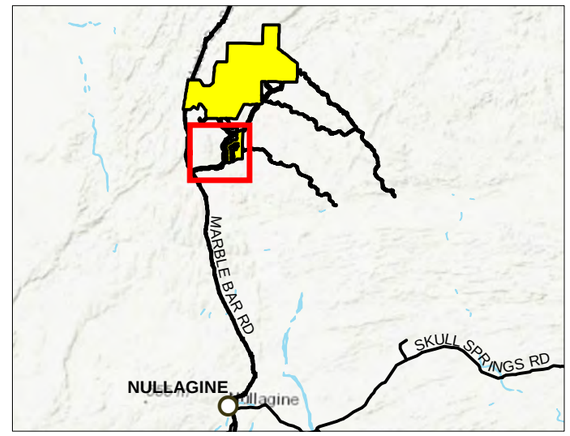
Previous Surveys (Atlas Iron & DBCA, 2020)

Priority 1

Phase 1 (Ecoscape, 2020)

Priority 1

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP

5H

824000
826000
828000
7602000
7600000
7598000

Aap

LEGEND

McPhee Creek Survey Area

Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

Priority 1

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
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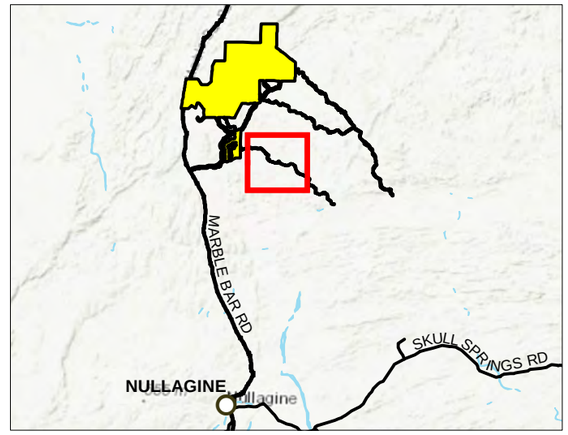


ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5I

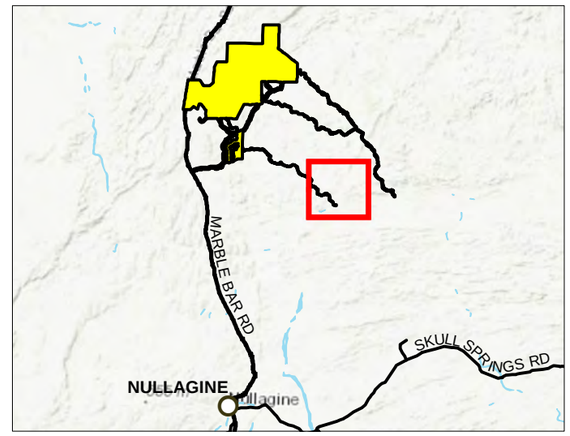
LEGEND

- McPhee Creek Survey Area
- Woodman (2014c)

Previous Surveys (Atlas Iron & DBCA, 2020)

- Priority 1

CODE	Species
Aap	*Acacia aphanoclada*
Ecr	*Eragrostis crateriformis*
Fsg	*Fimbristylis* sp. Shay Gap (K.R. Newbey 10293)
Gnu	*Goodenia nuda*
Pmo	*Ptilotus mollis*
Radl	*Rostellularia adscendens* var. *latifolia*
Ths	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)



ecoscape

CONSERVATION-LISTED FLORA AND SURVEY TRACKS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

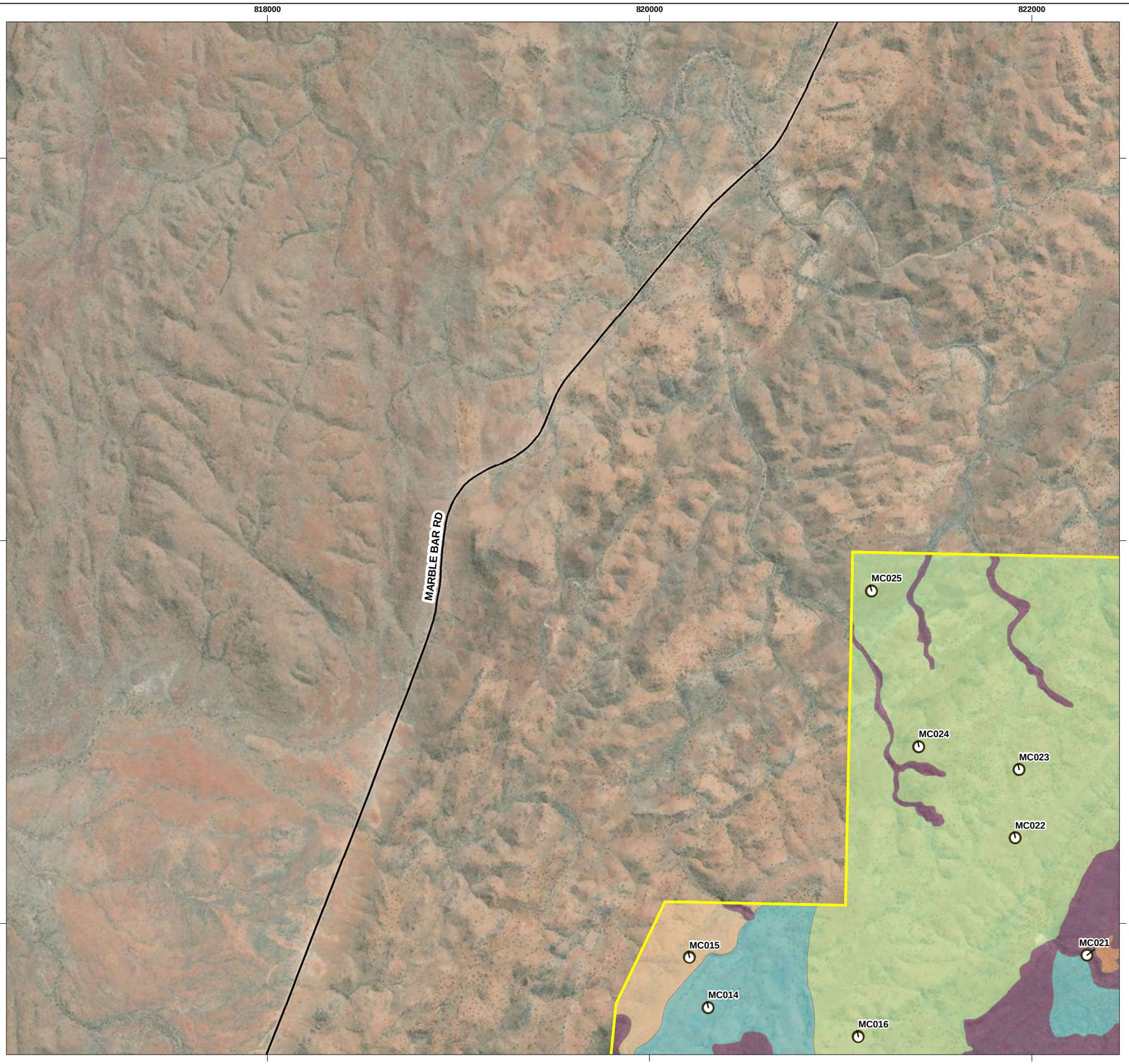
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	13/07/2020

MAP 5J



LEGEND

Survey Area Types

McPhee Creek Survey Area

Quadrat Locations

Existing Quadrats

Vegetation Types

- CcaAiTe: *Corymbia candida* subsp. *dipsodes, C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChAiTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland
- ChAmTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAbTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAptTe: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

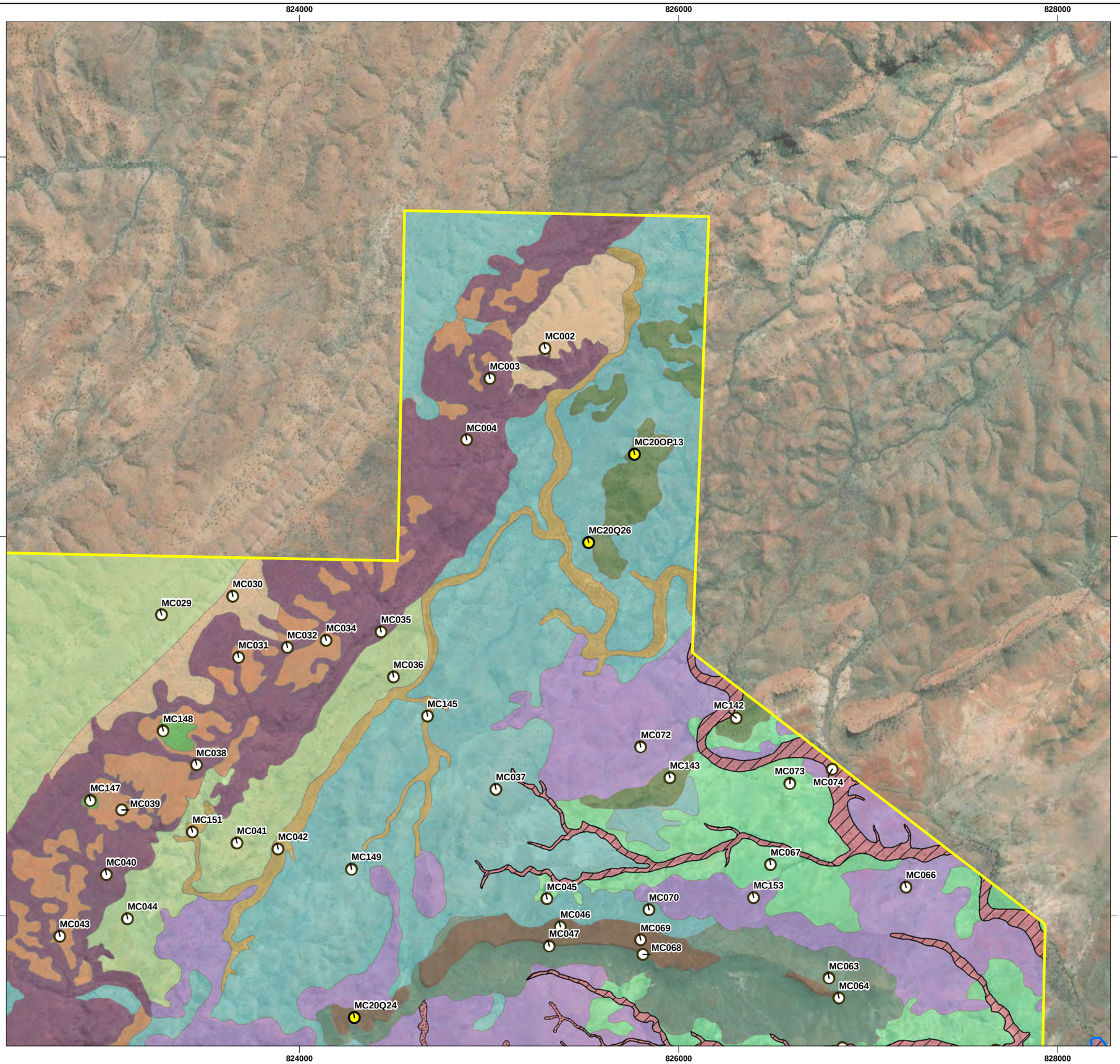
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6A



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats
- New Quadrats (Ecoscape, 2020)

Groundwater Dependent Vegetation Likelihood

- Potential
- Unlikely

Vegetation Types

- AiTw1: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* mid hummock grassland
- AsTl: *Acacia synchronicia* mid isolated shrubs
- CcaAiTe: *Corymbia candida* subsp. *dipsodes, C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChAiTa: *Corymbia hamersleyana* low isolated trees over *Acacia inaequilatera* tall isolated shrubs
- ChAiTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland
- ChAmTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChApyTt: *Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall shrubland
- ElAbTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAmTb: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAmTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAptTe: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland
- ElGwTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated clumps of trees
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

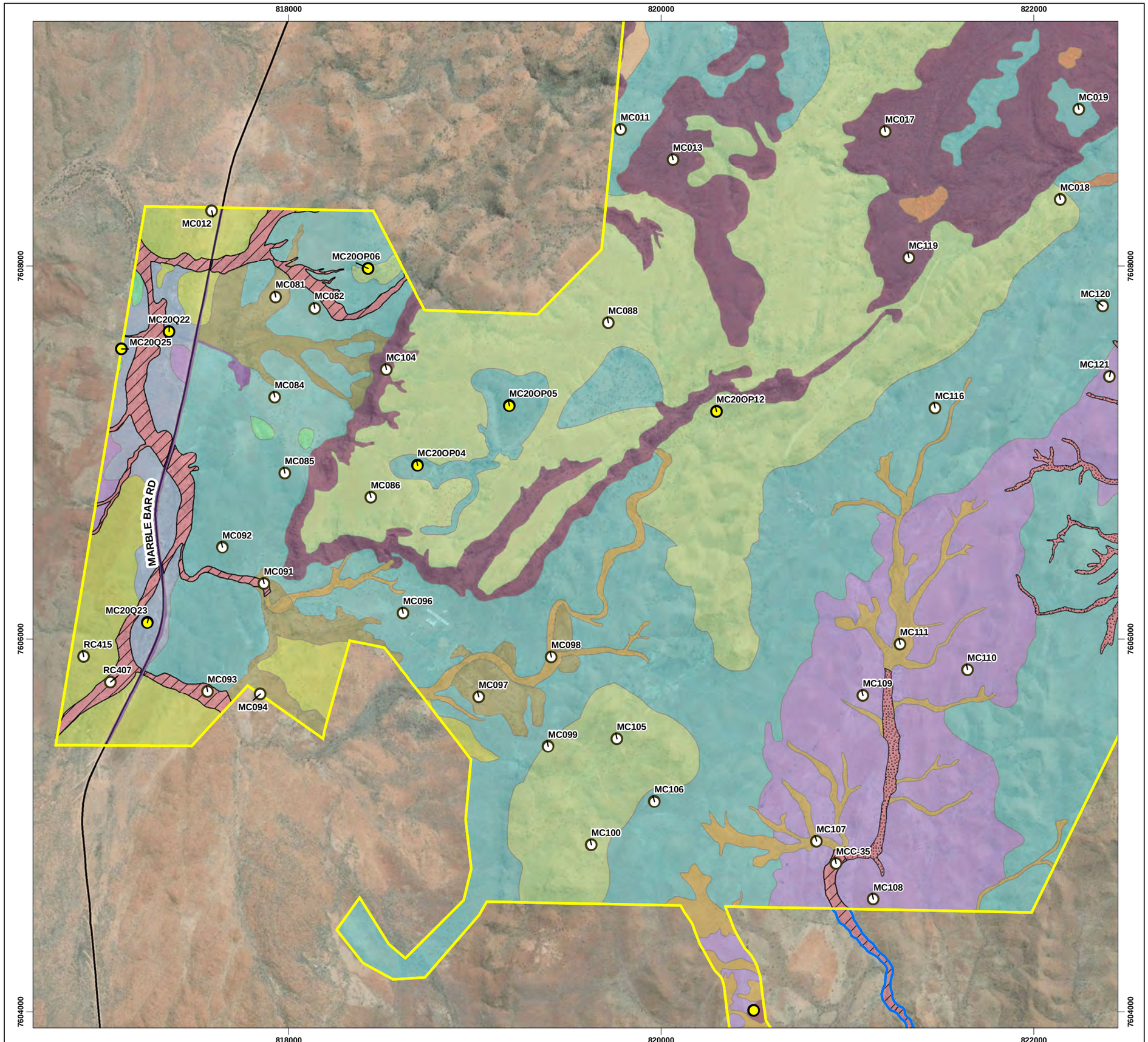
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6B



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats
- New Quadrats (Ecoscape, 2020)

Groundwater Dependent Vegetation Likelihood

- Potential
- Unlikely

Vegetation Types

- AiTw1: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* mid hummock grassland
- AiTw2: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* and *T. longiceps* mid hummock grassland
- AoAbTl: *Acacia orthocarpa, A. monticola* and *A. bivenosa* low sparse shrubland
- CcaAiTe: *Corymbia candida* subsp. *dipsodes, C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChAiTa: *Corymbia hamersleyana* low isolated trees over *Acacia inaequilatera* tall isolated shrubs
- ChAiTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland
- ChAiTw: *Corymbia hamersleyana* low isolated clumps of trees
- ChAmTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChApyTt: *Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall shrubland
- ElAbTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAptTe: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland
- Cleared

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

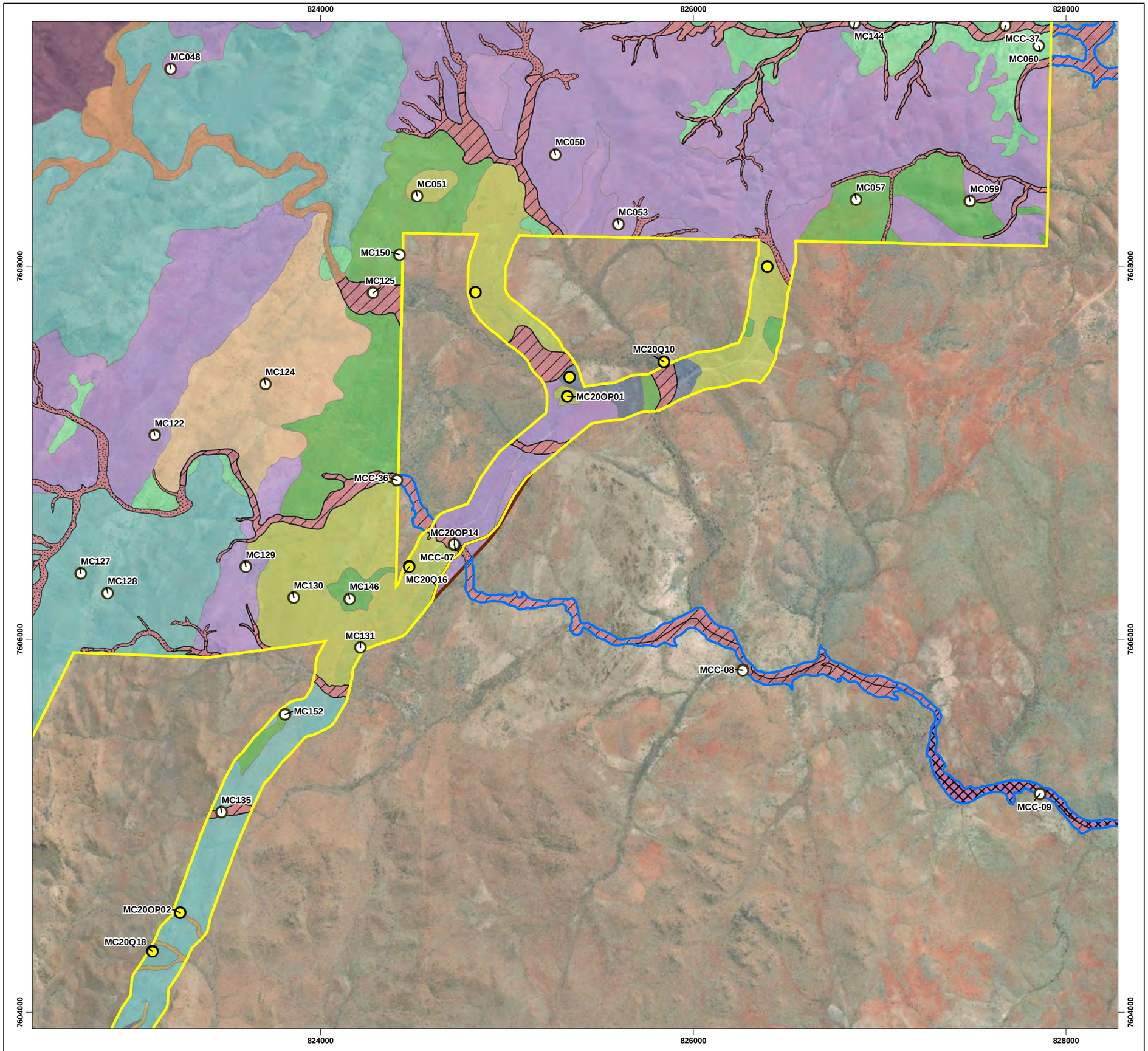
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6C



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Extrapolated
- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats
- New Quadrats (Ecoscape, 2020)

Groundwater Dependent Vegetation Likelihood

- Likely
- Potential
- Unlikely

Vegetation Types

- AiTw1: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* mid hummock grassland
- AiTw2: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* and *T. longiceps* mid hummock grassland
- AsTe: *Acacia synchronicia, A. bivenosa, A. inaequilatera* tall open shrubland
- AsTl: *Acacia synchronicia* mid isolated shrubs
- CcaAiTe: *Corymbia candida* subsp. *dipsodes, C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChAiTa: *Corymbia hamersleyana* low isolated trees over *Acacia inaequilatera* tall isolated shrubs
- ChAiTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland
- ChAmTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChApyTt: *Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall shrubland
- EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland
- ElAptTe: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland
- ElGwTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated clumps of trees
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

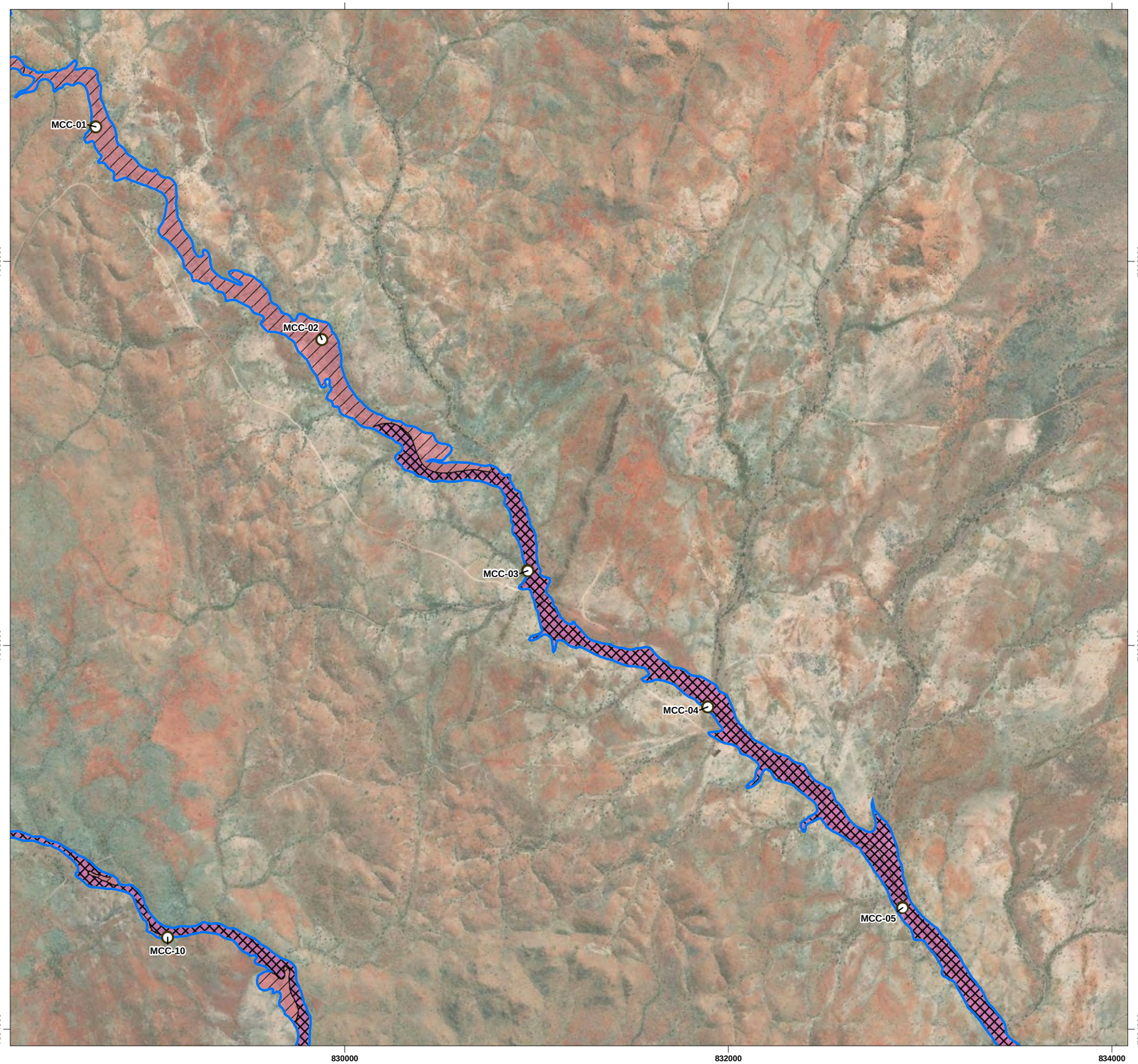
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6D



LEGEND

Survey Area Types

Interpolated (creeklines)

Quadrat Locations

Existing Quadrats

Groundwater Dependent Vegetation Likelihood

Likely

Potential

Vegetation Types

EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland

EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

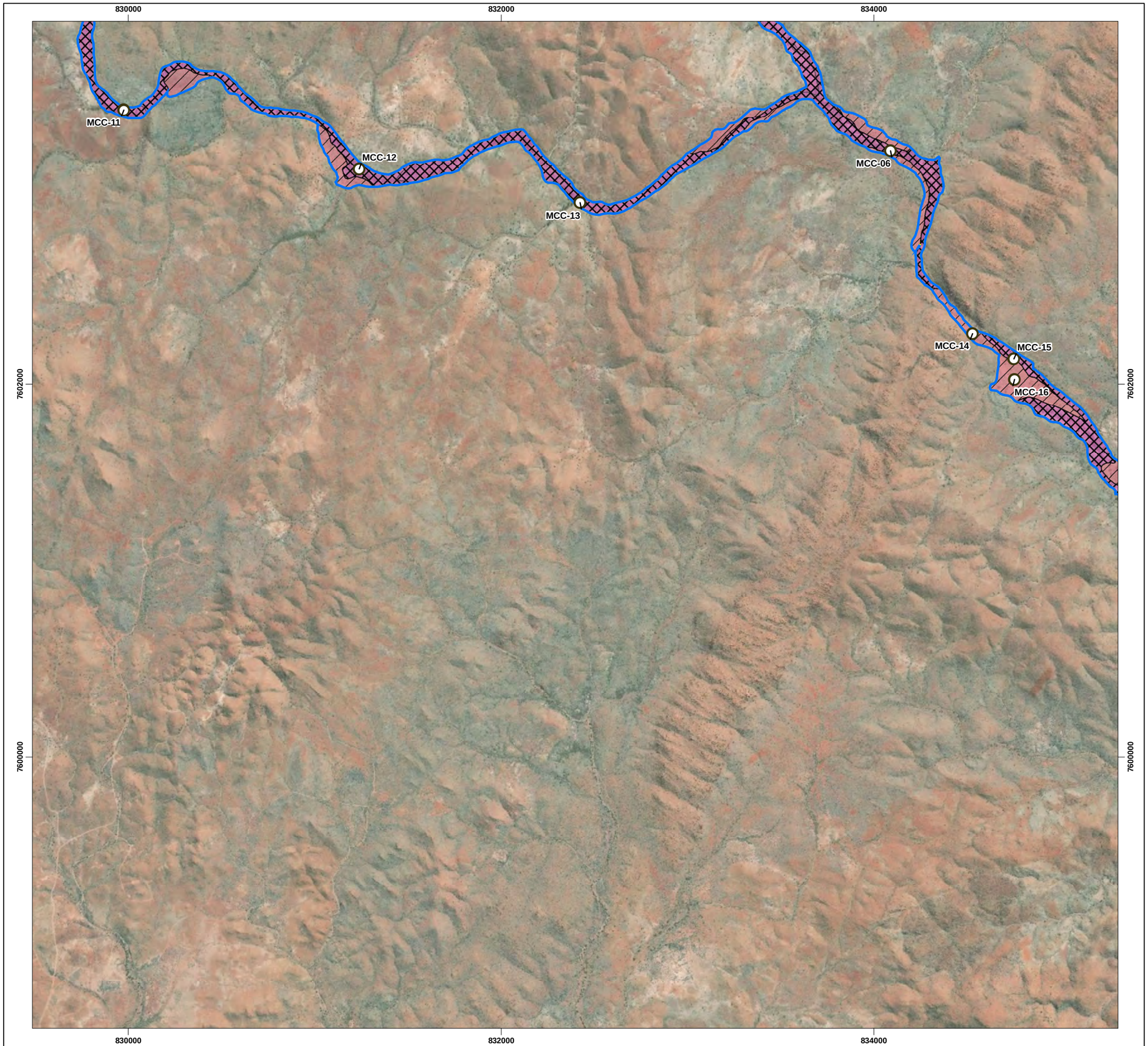
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6E



LEGEND

Survey Area Types

- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats

Groundwater Dependent Vegetation Likelihood

- Likely
- Potential

Vegetation Types

- EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

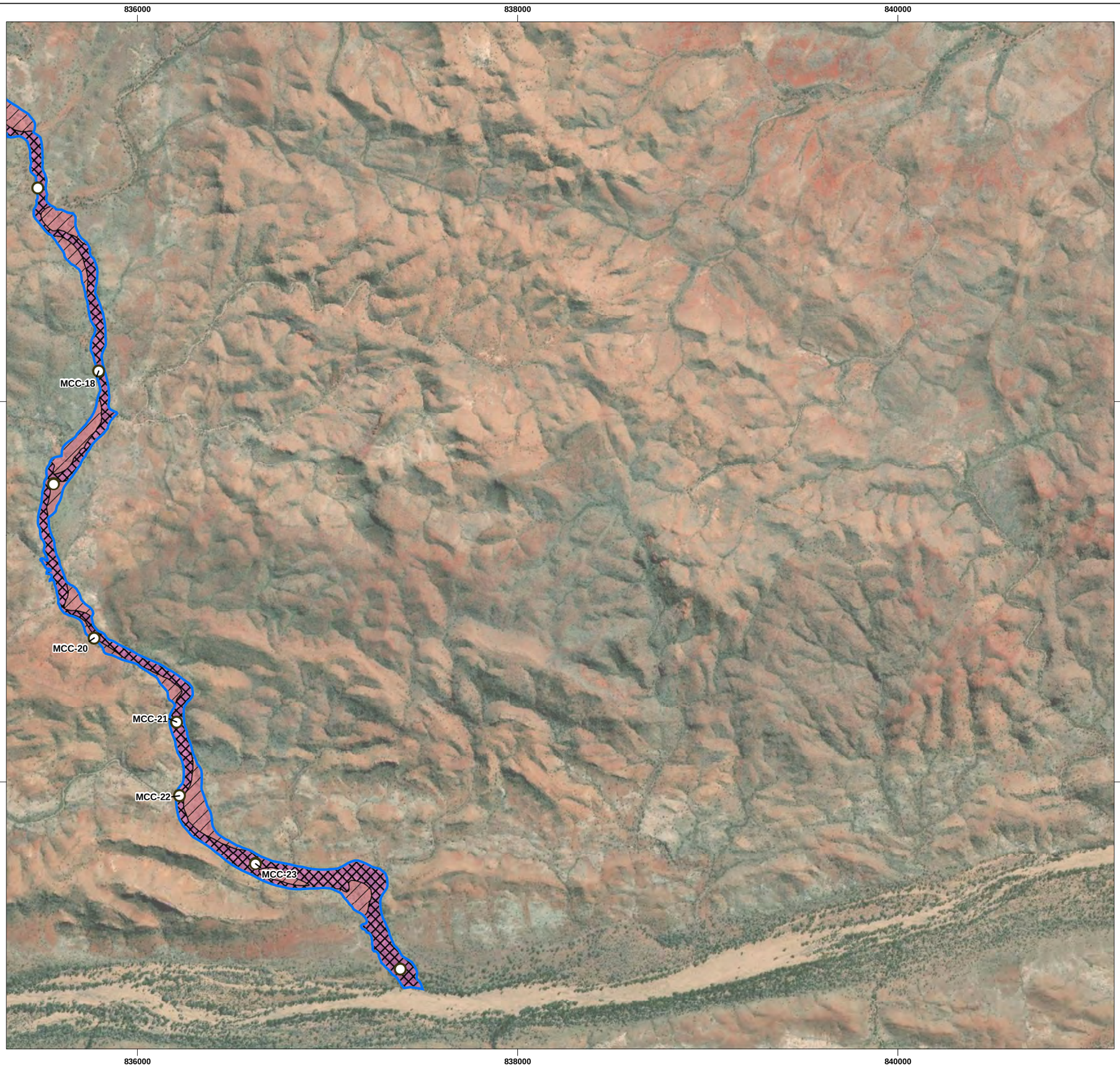
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6F



LEGEND

Survey Area Types

- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats

Groundwater Dependent Vegetation Likelihood

- Likely
- Potential

Vegetation Types

- EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

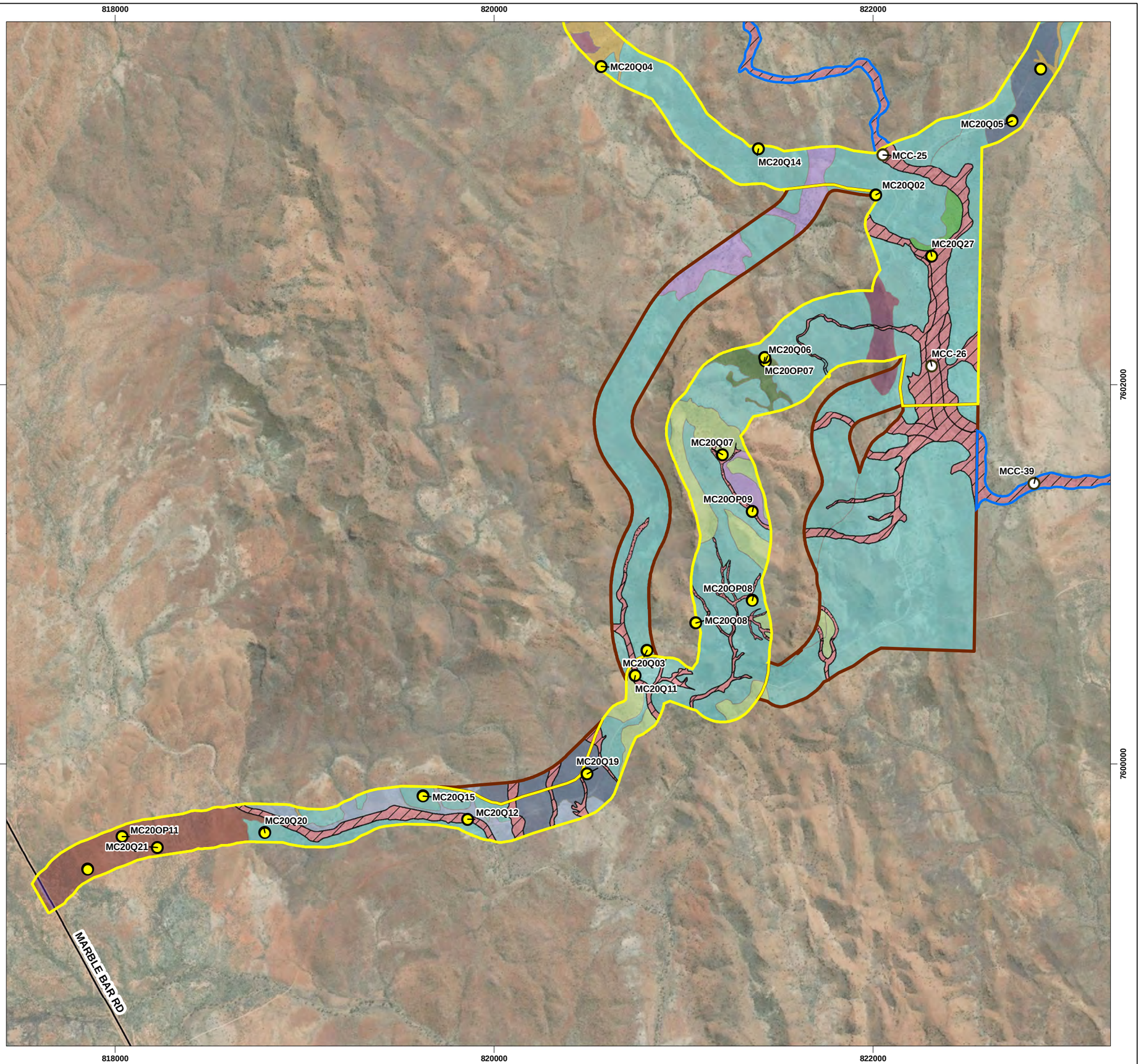
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6G



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Extrapolated
- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats
- New Quadrats (Ecoscape, 2020)

Groundwater Dependent Vegetation Likelihood

- Potential
- Unlikely

Vegetation Types

- AiTw1: *Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* mid hummock grassland
- AoAbTl: *Acacia orthocarpa, A. monticola* and *A. bivenosa* low sparse shrubland
- AsTe: *Acacia synchronicia, A. bivenosa, A. inaequilatera* tall open shrubland
- AsTl: *Acacia synchronicia* mid isolated shrubs
- AtrTe: *Acacia trachycarpa* low sparse mallee shrubland
- ChAiTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland
- ChAmTe: *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ChApyTt: *Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall shrubland
- ElAbTe: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- ElAmTb: *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland
- Cleared

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

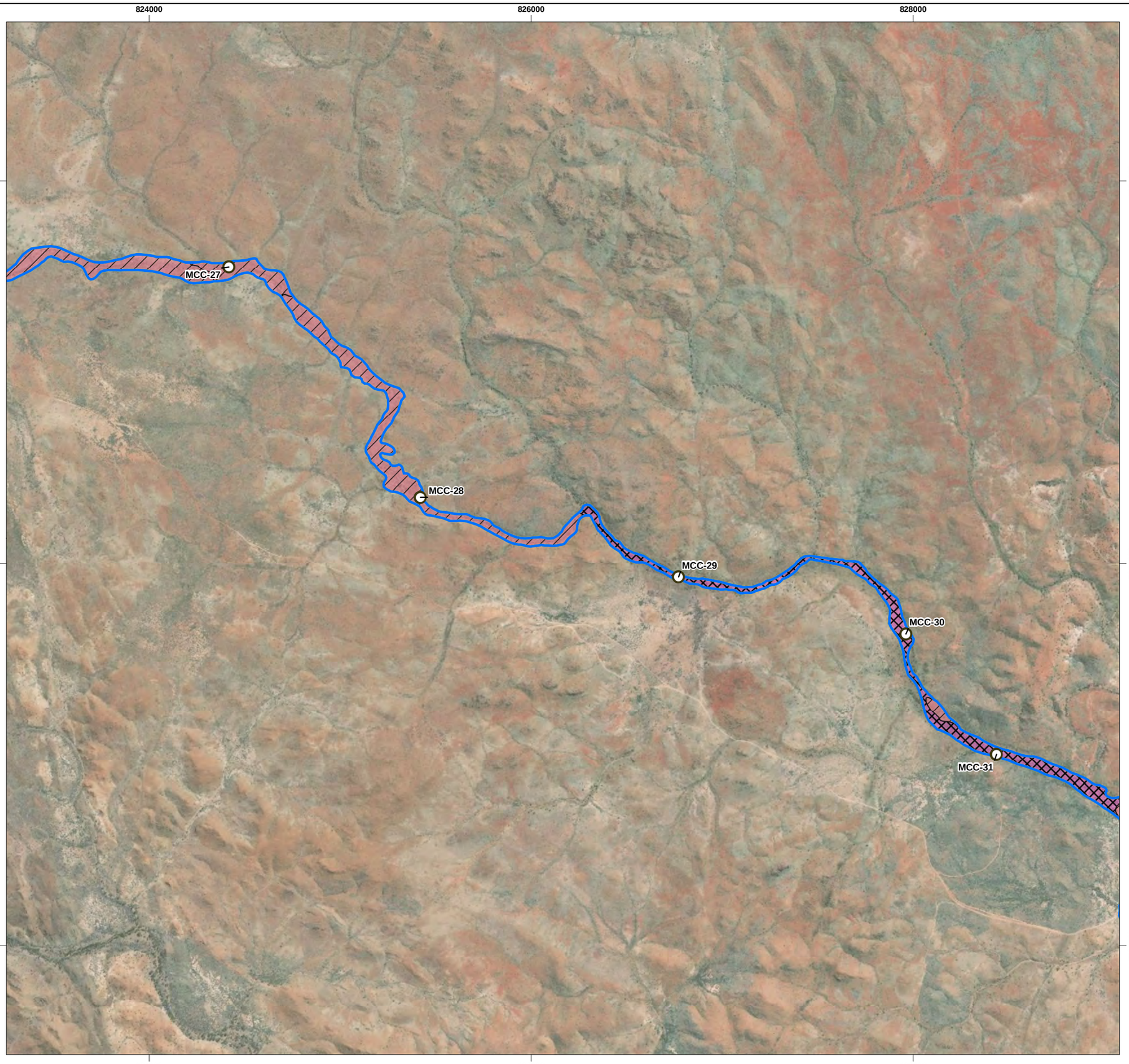
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6H



LEGEND

Survey Area Types

Interpolated (creeklines)

Quadrat Locations

Existing Quadrats

Groundwater Dependent Vegetation Likelihood

Likely

Potential

Vegetation Types

EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland

EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

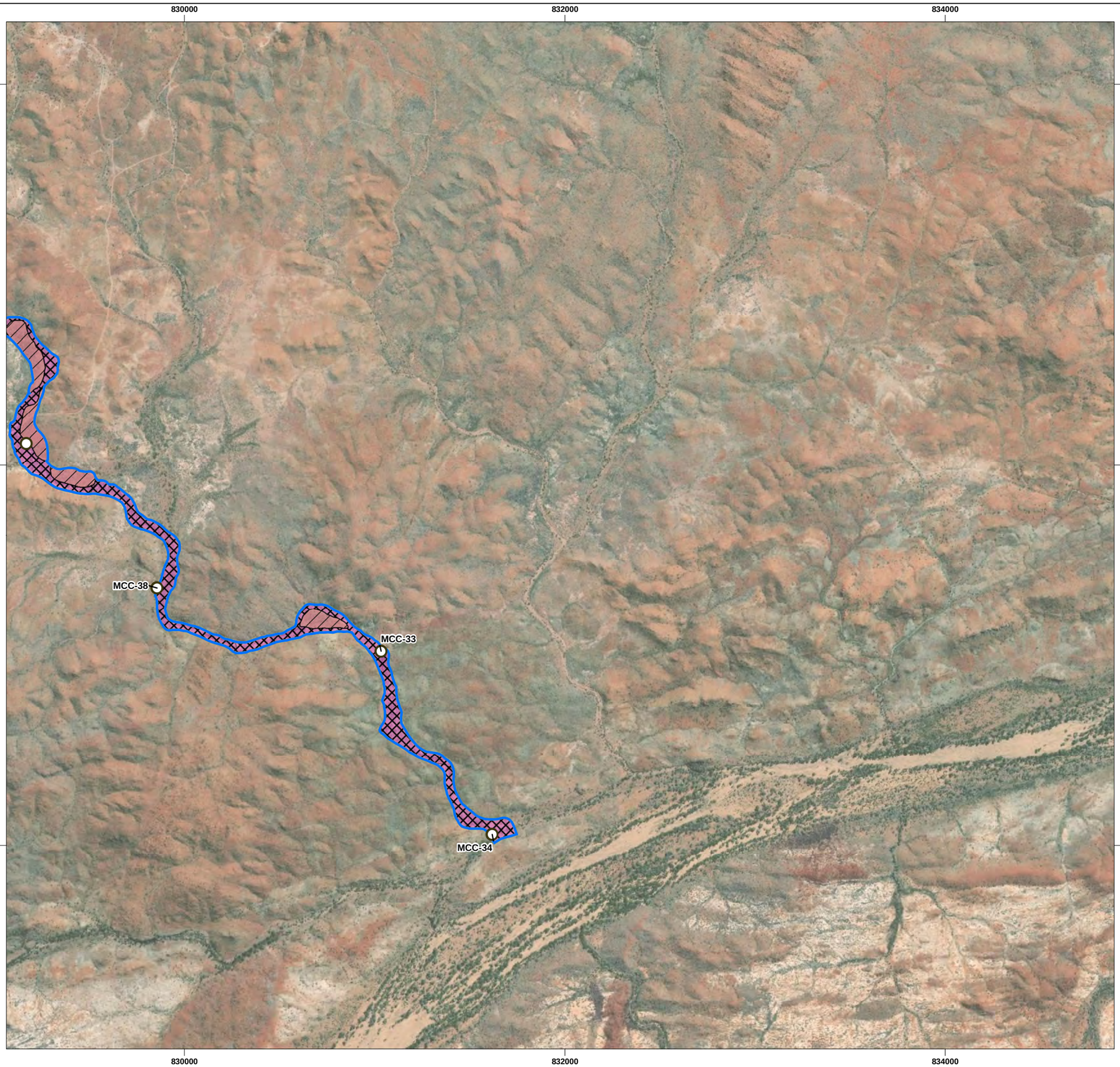
SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6I



LEGEND

Survey Area Types

- Interpolated (creeklines)

Quadrat Locations

- Existing Quadrats

Groundwater Dependent Vegetation Likelihood

- Likely
- Potential

Vegetation Types

- EcApyCci: *Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia, Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland
- EvApyCci: *Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia, Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland

DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION TYPES AND QUADRAT LOCATIONS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:20,000 @ A3

0 0.4 0.8 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	16/06/2020

MAP 6J

816000 818000 820000 822000

7614000

7612000

7610000

MC025

MC024

MC023

MC147

MC022

MC040

MC021

Sv

MC043

MC015

MC014

MC016

MC019

MC011

MC017

LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Weeds

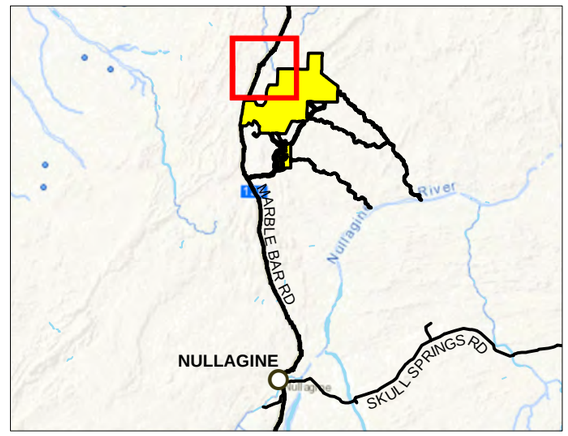
Quadrat Locations

- Excellent

Vegetation Condition

- Excellent
- Good

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

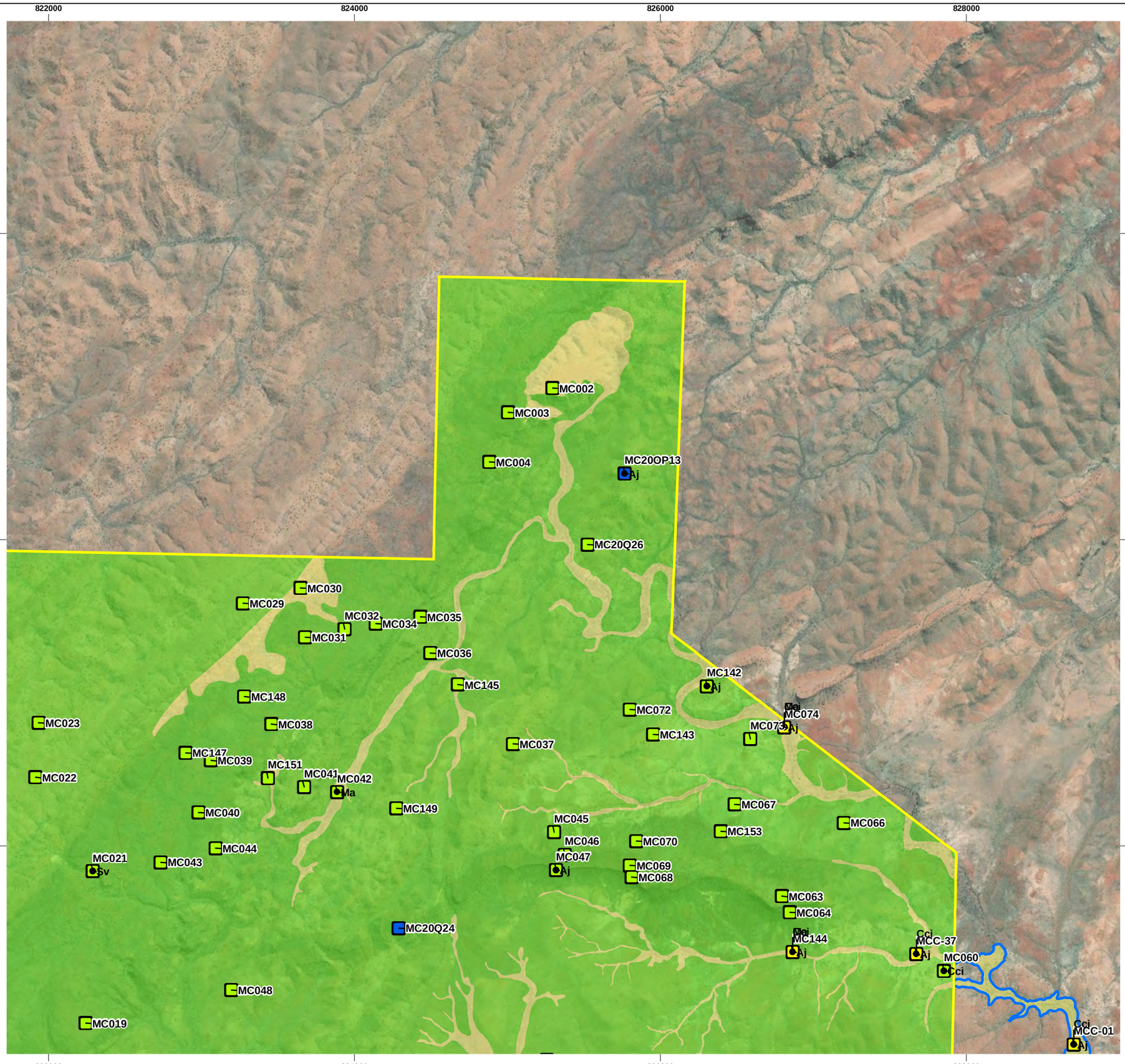
SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7A



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Interpolated (creeklines)
- Weeds

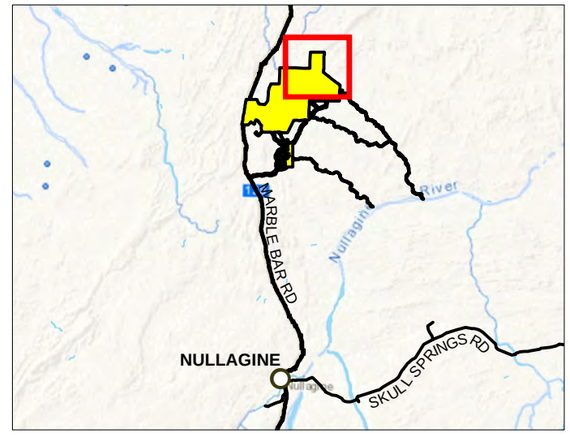
Vegetation Condition

- Excellent
- Good

Quadrat Locations

- Excellent
- Very Good
- Good

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP
7B

816000 818000 820000 822000

7608000 7606000 7604000

MC021 Sv MC043 MC015 MC014 MC016 MC019 MC011 MC017 MC013 MC012 Cs MC018 MC119 MC20OP06 MC081 MC082 Cs MC20Q22 Cci MC20Q25 MC088 MC120 MC104 MC121 MC084 MC20OP05 MC20OP12 MC116 MC085 MC20OP04 MC086 MC092 MC091 Cci Cs MC20Q23 Cci Cp MC127 MC128 MC096 Pla MC111 Aj RC415 Cci Cs RC407 Cci Ft MC093 Cci MC094 MC098 MC110 MC097 MC109 MC099 MC105 MC106 MC107 Ma MCC-35 Cci MC100 MC108 Cp MC20Q09 MC20Q04 MC20OP MC20Q05 MC20Q14

LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Interpolated (creeklines)
- Weeds

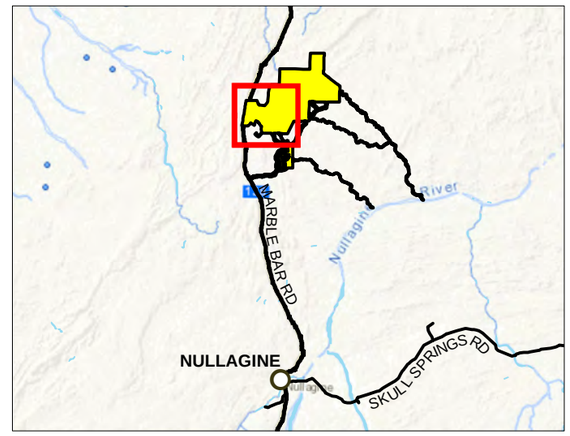
Vegetation Condition

- Excellent
- Very Good
- Good
- Cleared

Quadrat Locations

- Excellent
- Very Good
- Good
- Poor

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

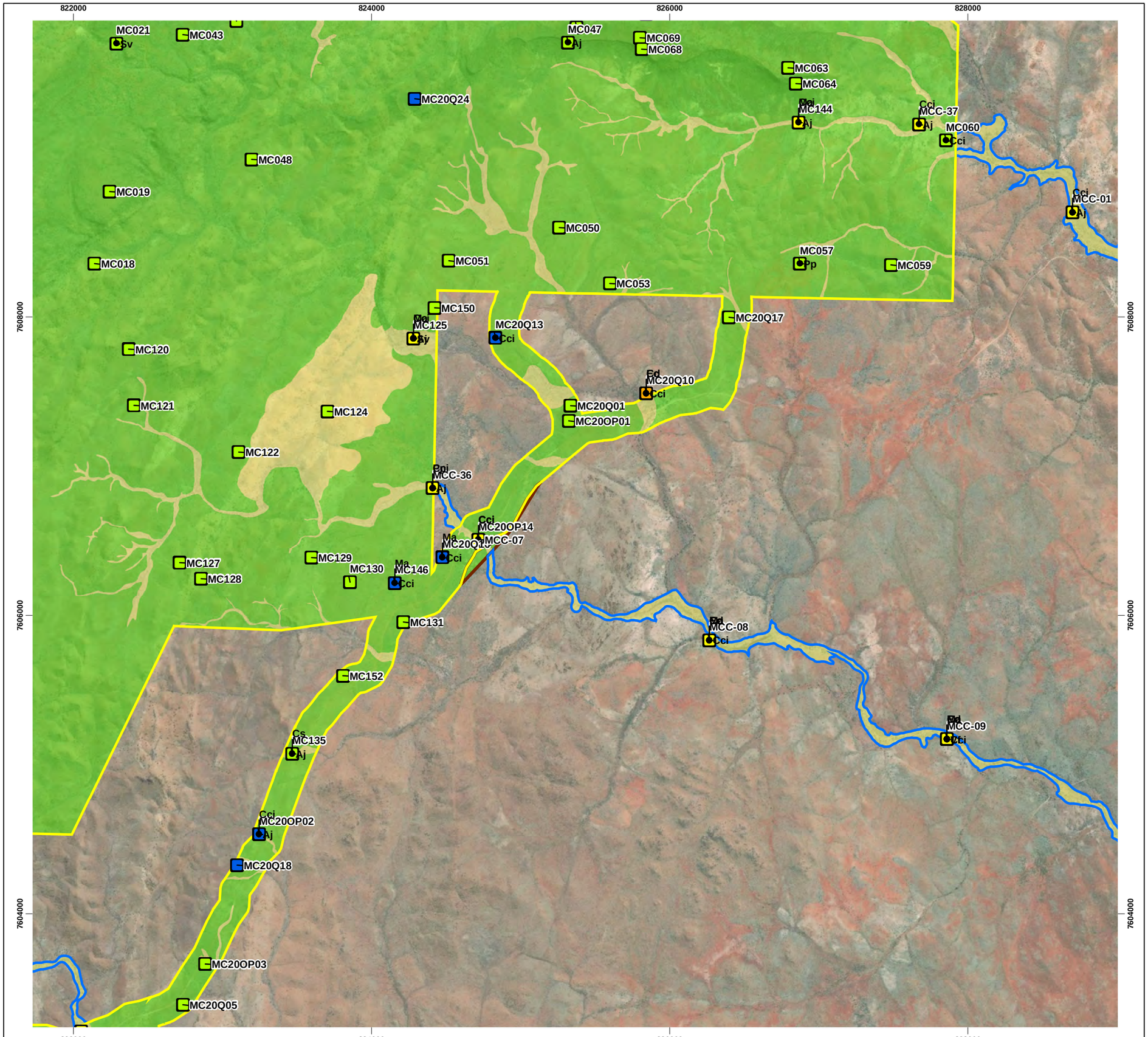
SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7C



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Extrapolated
- Interpolated (creeklines)
- Weeds

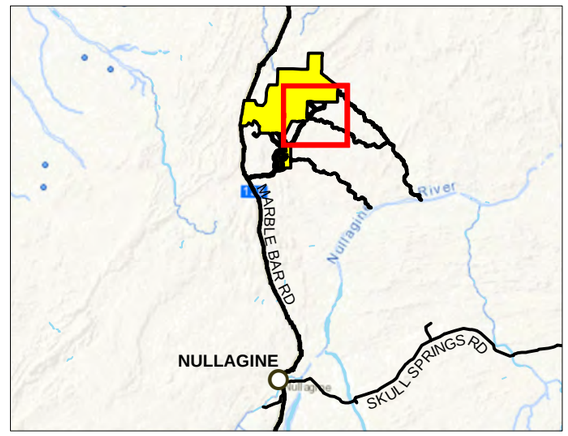
Quadrat Locations

- Excellent
- Very Good
- Good
- Poor

Vegetation Condition

- Excellent
- Good

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7D

828000 830000 832000 834000

7608000 7606000 7604000

Cci MCC-37 Aj
MC060 Cci
Cci MCC-01 Aj
Cci MCC-02 Aj
So MCC-03 Cci
So MCC-04 Cci
Cci MCC-05 Aj
Cci MCC-06
Bid MCC-09 Cci
Ba MCC-10 Soi
Soi MCC-11 Aa

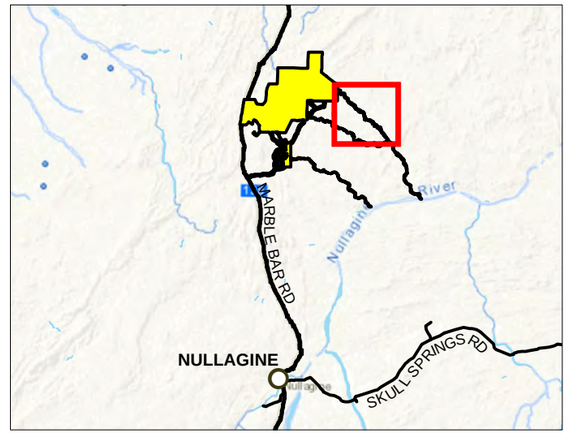
LEGEND

Survey Area Types
- McPhee Creek Survey Area
- Interpolated (creeklines)
- Weeds

Vegetation Condition
- Excellent
- Very Good
- Good
- Poor
- Degraded

Quadrat Locations
- Excellent
- Good
- Poor
- Degraded

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

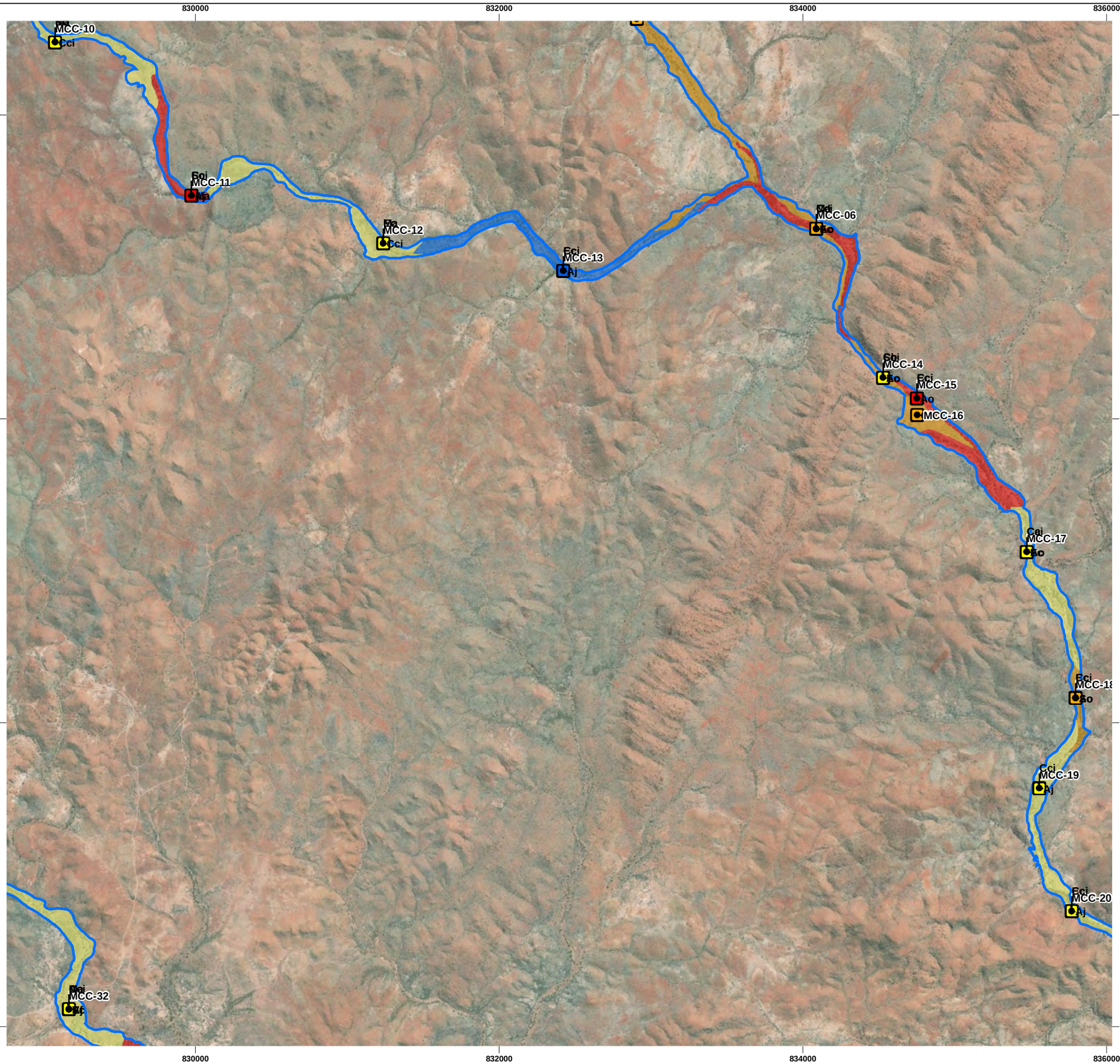
SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7E



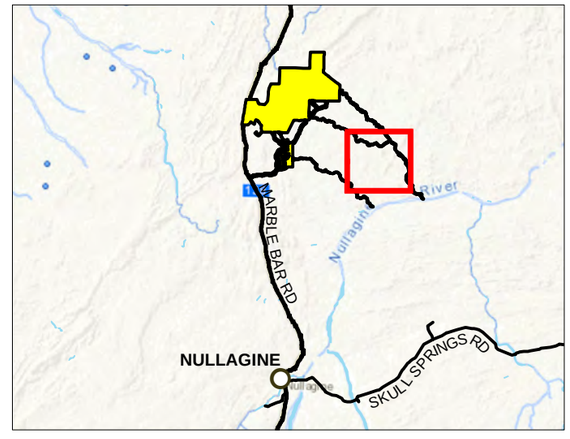
LEGEND

Survey Area Types
- Interpolated (creeklines)
- Weeds

Vegetation Condition
- Very Good
- Good
- Poor
- Degraded

Quadrat Locations
- Very Good
- Good
- Poor
- Degraded

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK
FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP
7F

836000 838000 840000

7602000 7600000 7598000 7596000

Eci MCC-15 Ao
MCC-16
Cai MCC-17 Ao
Eci MCC-18 Ao
Cci MCC-19 Aj
Eci MCC-20 Aj
MCC-21 Cci
Cci MCC-22 Aj
Cci MCC-23 Aj
Ed MCC-24 Eci

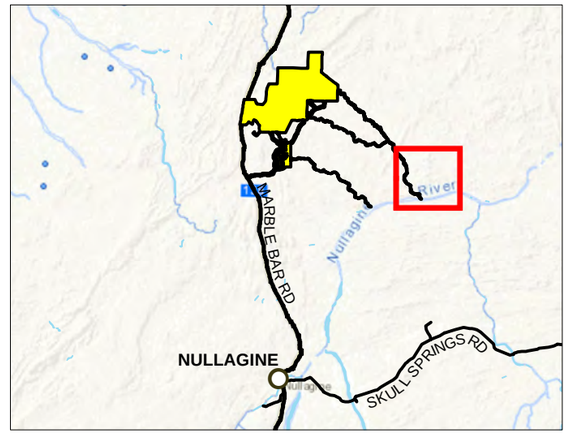
LEGEND

Survey Area Types
- Interpolated (creeklines)
- Weeds

Vegetation Condition
- Good
- Poor
- Degraded

Quadrat Locations
- Good
- Poor
- Degraded

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
Cci	*Cenchrus ciliaris*	Ma	*Malvastrum americanum*
Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
Cb	*Chloris barbata*	Sv	*Setaria verticillata*
Ca	*Citrullus amarus*	So	*Sonchus oleraceus*
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

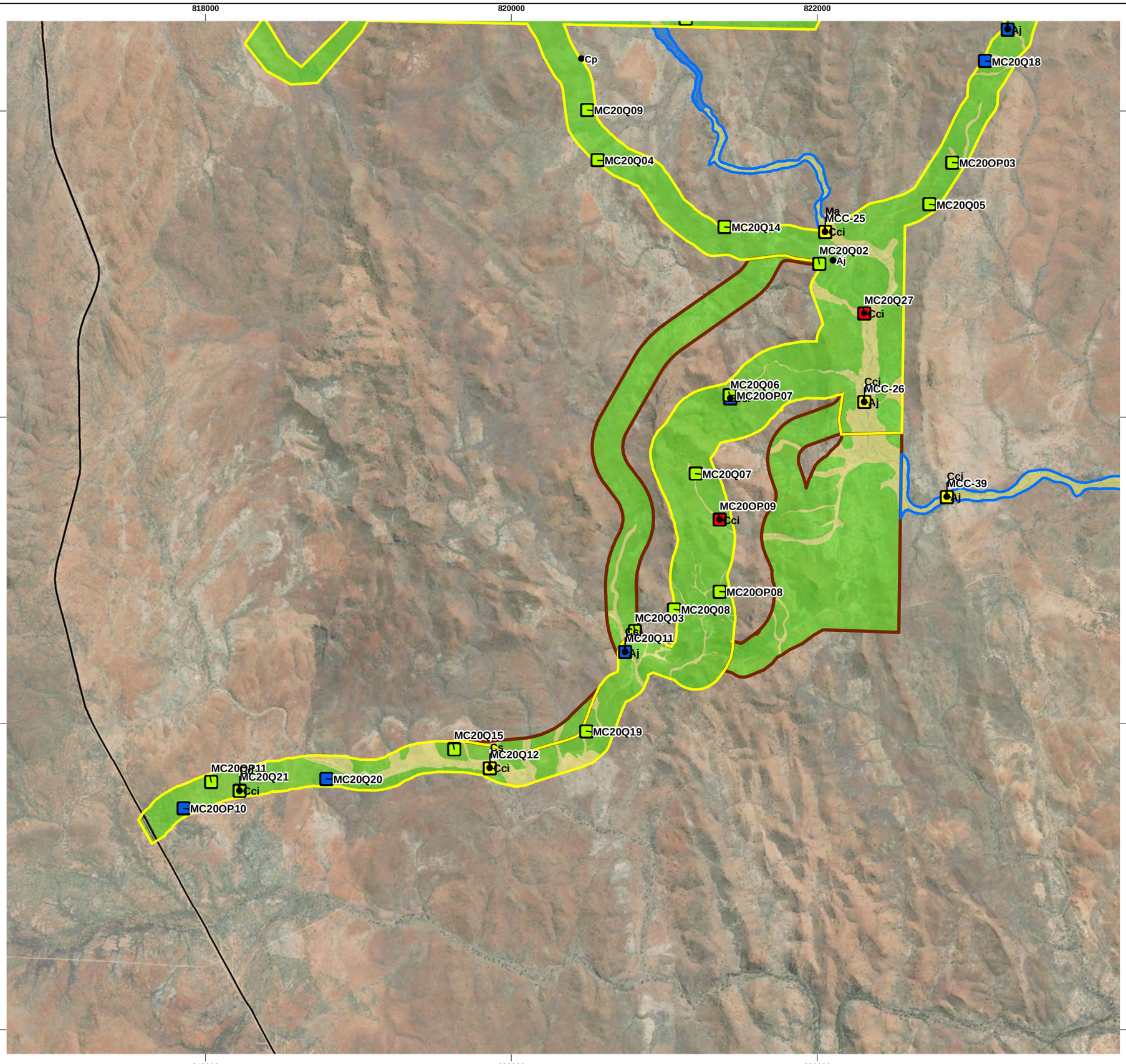
SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7G



LEGEND

Survey Area Types

- McPhee Creek Survey Area
- Extrapolated
- Interpolated (creeklines)
- Weeds

Quadrat Locations

- Excellent
- Very Good
- Good
- Degraded

Vegetation Condition

- Excellent
- Very Good
- Good
- Cleared

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
Cp	*Calotropis procera*	Ft	*Flaveria trinervia*
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Cs	*Cenchrus setiger*	Pp	*Portulaca pilosa*
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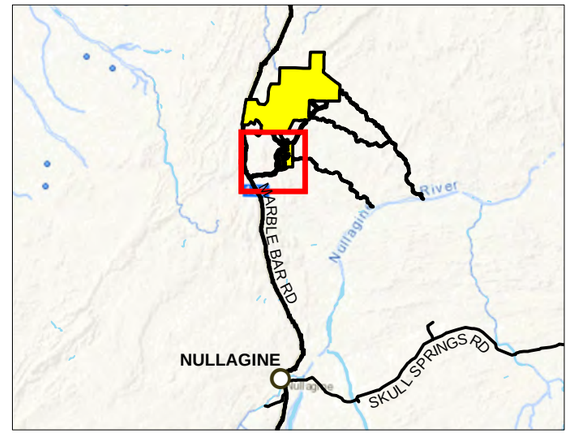
Cd	*Cynodon dactylon*	Vf	*Vachellia farnesiana*



DATA SOURCES:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,

ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP
7H

824000
826000
828000
7602000
7600000
7598000
MC20Q05
MCC-39
Cci
Aj
MCC-27
Ra
Cci
MCC-28
Ra
Cci
MCC-29
Eoi
Ma
MCC-30
Eoi
Ma
MCC-31
Eoi
MCC-32
Eoi

LEGEND

Survey Area Types
- McPhee Creek Survey Area
- Extrapolated
- Interpolated (creeklines)
- Weeds

Quadrat Locations
- Excellent
- Very Good
- Good
- Poor
- Degraded

Vegetation Condition
- Excellent
- Very Good
- Good
- Degraded

Code	Species	Code	Species
Aj	*Aerva javanica*	Ec	*Echinochloa colona*
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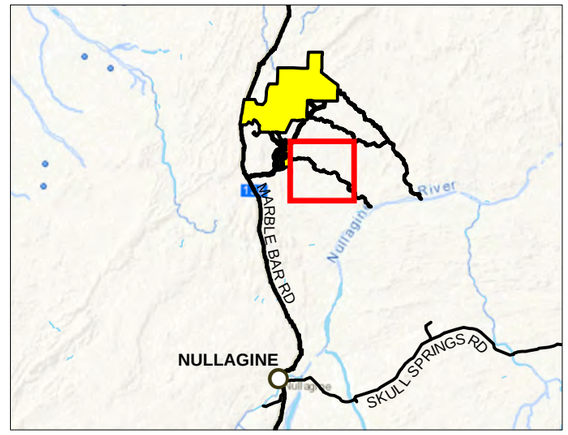

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ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

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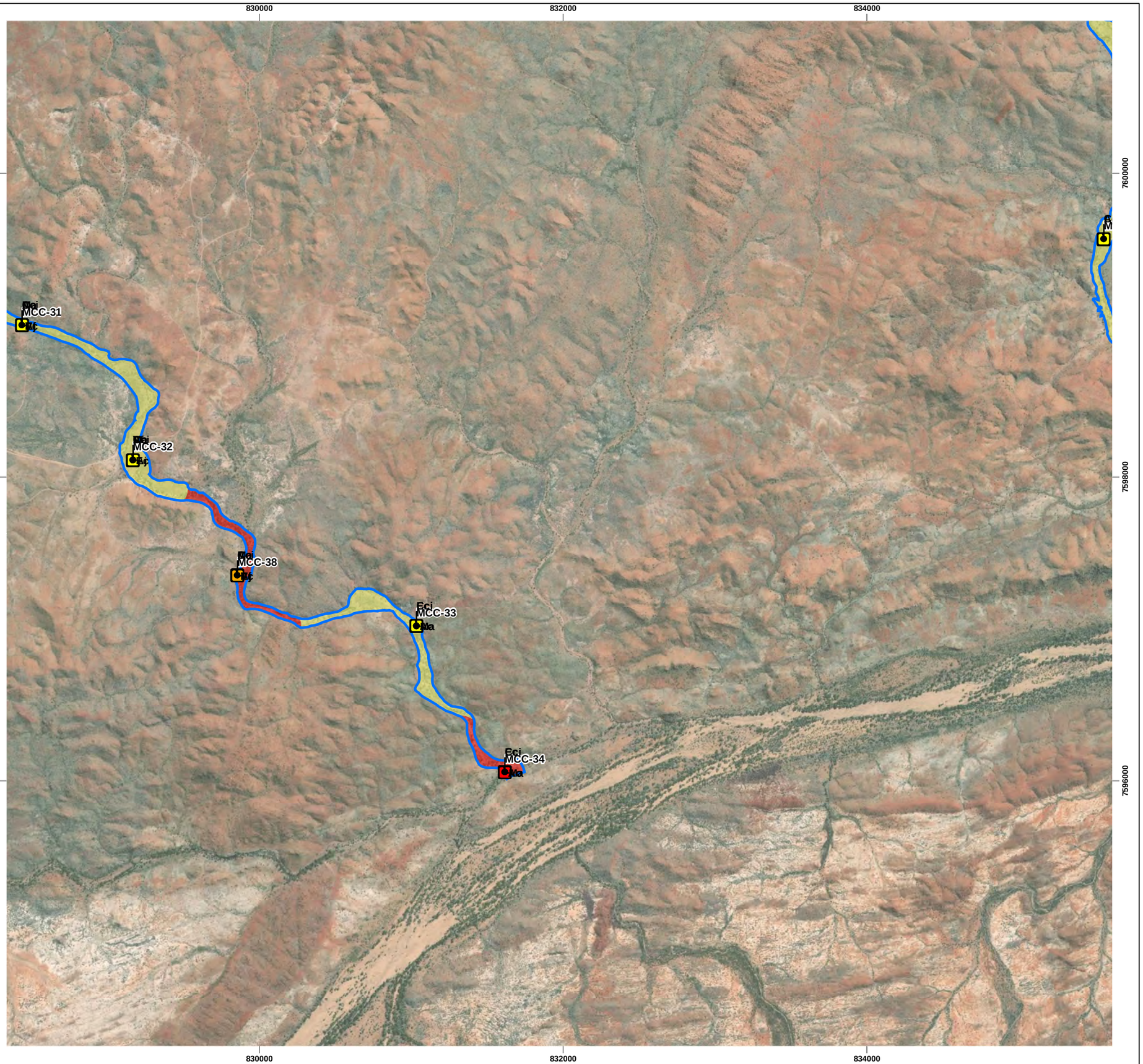
SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP 7I



LEGEND

Survey Area Types

- Interpolated (creeklines)
- Weeds

Vegetation Condition

- Good
- Degraded

Quadrat Locations

- Good
- Poor
- Degraded

Code	Species	Code	Species
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Ao	*Argemone ochroleuca*	Eh	*Euphorbia hirta*
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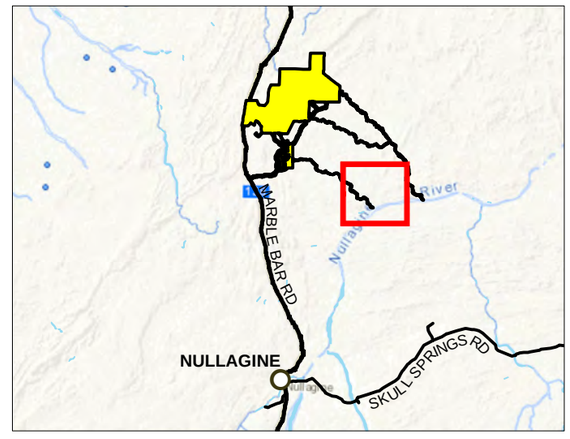

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ecoscape

VEGETATION CONDITION AND WEEDS

MCPHEE CREEK
FLORA AND VEGETATION SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

ATLAS

N

SCALE: 1:25,000 @ A3

0 0.5 1 km

PROJECT NO: 4510-20

REV	AUTHOR	APPROVED	DATE
LJA	JLT	LJA	14/07/2020

MAP
7 J

APPENDIX ONE DEFINITIONS AND CRITERIA

Table 17: EPBC Act categories for flora and fauna

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

Table 18: Conservation codes for Western Australian flora and fauna (DBCA 2019)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. **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 *Biodiversity Conservation Act 2016*.** **Categories of Threatened, Extinct and Specially Protected fauna and flora are:**	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be *facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*. Listed as critically endangered undersection 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
EN	**Endangered species** Threatened species considered to be *facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.
VU	**Vulnerable species** Threatened species considered to be *facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*. Listed as vulnerable undersection 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.
Extinct species **Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.**	
EX	**Extinct species** Species where *there is no reasonable doubt that the last member of the species has died*, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
EW	Extinct in the wild species Species that *is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*, and listing is otherwise in accordance with the ministerial guidelines (section 25of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species **Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.** **Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.**	

Conservation Codes for Western Australian Flora and Fauna	
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18of the BC Act). Published as other specially protected fauna under schedule 7of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
P	**Priority species** Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Conservation Codes for Western Australian Flora and Fauna	
4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
[1] The definition of flora includes algae, fungi and lichens. **[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).**	

Table 19: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Criteria	Definition
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	*Poorly known ecological communities* Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	*Poorly known ecological communities* Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.

Criteria	Definition
Priority Three	*Poorly known ecological communities* i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	*Conservation Dependent Ecological Communities* Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table 20: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group 2017)

	Cover characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herbs	herb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 21: NVIS height classes (NVIS Technical Working Group 2017)

Height		Growth form				
Height Class	Height Range (m)	Tree, vine (M & U), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)	Bryophyte, lichen, seagrass, aquatic
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low
Source: (based on Walker & Hopkins 1990)						

Table 22: Vegetation Condition Scale for the Eremaean and Northern Botanical Provinces (EPA 2016c)

Condition rating	Description
Excellent	Pristine or nearly so, no obvious signs of disturbance or 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.

APPENDIX TWO DESKTOP ASSESSMENT RESULTS

Table 23: Flora database search results (DBCA database search), likelihood and flora survey records

Species name	Habitat from *FloraBase* (WAH 1998-2020) or (for *Acacia* species) *World Wide Wattle* (Shire of Dalwallinu *et al.* 2010)	Distance from survey area (km)	Likelihood of occurrence	
			Desktop	Post-survey
DBCA Priority 1				
Acacia aphanoclada	Slender, wispy shrub, 1.7–5 m high. Flowering yellow from August to October. Growing on rocky hills, ridges and rises in skeletal stony soils.	0	Recorded	Recorded
Acacia cyperophylla var. *omearana*	Tree, 4–10 m high, 'minniritchi' bark. Flowering yellow from March to April. Growing along drainage lines in stony and gritty alluvium.	23	Unlikely	Highly unlikely
Acacia fecunda	Erect, obconic shrub, to 3 m high, bark grey, smooth becoming yellow–brown on upper branches; phyllodes more or less sub-glaucous with a slight sheen; inflorescence of spikes. Flowering yellow in May or August. Growing along shallow creeks and drainage lines, hills, road verges in quartzite gibbers over grey-red skeletal soil.	31	Unlikely	Unlikely
Acacia sp. Marble Bar (J.G. & M.H. Simmons 3499)	Shrub, inflorescence in spikes, to 30 mm long. Flowering yellow in September.	44	Highly unlikely	Highly unlikely
Acacia sp. Nullagine (B.R. Maslin 4955)	Erect, spindly shrub, to 3 m high, bark minniritchi, grey above, red underneath. Rocky clay. Low-lying areas between rocky hills.	9	Unlikely	Unlikely
Atriplex spinulosa	Monoecious, erect, rounded annual, herb, ca 0.2 m high.	28	Unlikely	Highly unlikely
Cochlospermum macnamarae	Multi-stemmed shrub, to 2 m high. Flowering yellow. Grows on upper slopes in shallow skeletal soil over granitic bedrock.	24	Unlikely	Unlikely
Fimbristylis sp. Shay Gap (K.R. Newbey 10293)	Tufted annual, grass-like or herb (sedge), 0.12–0.15 m high, inflorescence of 3–many spikelets; glumes 2–2.5 mm long; stamens 3, anthers 0.5–0.6 mm long. Flowering June to July. Growing in drainage lines on sandy soil.	11	Unlikely	Unlikely
Ptilotus wilsonii	Shrub, ca 0.5 m high. Flowering green–white in October. Growing on rocky hills in stony gravelly soils.	23	Highly unlikely	Highly unlikely
Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795)	Grows on clay plains in light brown clay.	31	Highly unlikely	Highly unlikely
Stemodia sp. Battle Hill (A.L. Payne 1006)	Low shrub. Growing on floodplains in cracking clay.	50	Highly unlikely	Highly unlikely
DBCA Priority 2				
Indigofera ixocarpa	Shrub, to 1 m high. Flowering pink in May. Growing on skeletal red soils over massive ironstone.	24	Highly unlikely	Highly unlikely
DBCA Priority 3				
Acacia levata	Spreading, multi-stemmed shrub, 1–3 m high, to 5 m wide. Flowering yellow in May. Growing on hillslopes in sand or sandy loam over granite.	39	Highly unlikely	Highly unlikely
Eragrostis crateriformis	Annual, grass-like or herb, 0.17-0.42 m high. Flowering from January to May or July. Growing on creek banks and depressions in clayey loam or clay.	0	Recorded	Recorded
Eucalyptus rowleyi	Mallee. Growing on hard red soil on flat lowland sites*.	33	Unlikely	Highly unlikely
Heliotropium murinum	Short-lived perennial, herb, up to 0.4 m high. Flowering May or September. Growing on red sand plains.	34	Highly unlikely	Highly unlikely
Heliotropium muticum	Ascending to spreading perennial, herb, to 0.3 m high.	45	Highly unlikely	Highly unlikely
Nicotiana umbratica	Erect, short-lived annual or perennial, herb, 0.3–0.7 m high. Flowering white from April to June. Grows on rocky outcrops in shallow soils.	33	Unlikely	Unlikely
Rostellularia adscendens var. *latifolia*	Herb or shrub, 0.1–0.3 m high. Flowering blue-purple-violet from April to May. Grows near creeks and rocky hills in ironstone soils.	0	Recorded	Recorded
Swainsona thompsoniana	Erect, herb. Flowering blue in April, June and August. Flood plains on heavy clay soils and is associated with *Eremophila maculata, Astrebla pectinata* and *Aristida latifola*.	50	Highly unlikely	Highly unlikely

Species name	Habitat from *FloraBase* (WAH 1998-2020) or (for *Acacia* species) *World Wide Wattle* (Shire of Dalwallinu *et al.* 2010)	Distance from survey area (km)	Likelihood of occurrence	
			Desktop	Post-survey
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Perennial tussock grass, 0.9–1.8 m high. Flowering in August. Grows on clay plan or grass plains in red clay.	7	Unlikely	Highly unlikely
Triodia basitricha	Curly perennial hummock grass. Occurs on rocky and gravelly slops of mountainous or low hills^.	26	Highly unlikely	Highly unlikely
Acacia levata	Spreading, multi-stemmed shrub, 1–3 m high, to 5 m wide. Flowering yellow in May. Growing on hillslopes in sand or sandy loam over granite.	39	Highly unlikely	Highly unlikely
DBCA Priority 4				
Bulbostylis burbidgeae	Tufted, erect to spreading annual, grass-like or herb (sedge), 0.03–0.25 m high, spikelets in a simple umbel or rarely solitary. Flowering in March or June to August. Grows on granite outcrops and cliff bases on granitic soils.	28	Highly unlikely	Highly unlikely
Goodenia nuda	Erect to ascending herb, to 0.5 m high. Flowering yellow from April to August.	0	Recorded	Recorded
Lepidium catapycnon	Open, woody perennial, herb or shrub, 0.2–0.3 m high, stems zigzag. Flowering white in October. Growing on hillsides in skeletal soils.	30	Highly unlikely	Highly unlikely
Ptilotus mollis	Compact, perennial shrub, to 0.5 m high, soft grey foliage. Flowering white/pink in May or September. Growing on steep stony hills and screes.	0	Recorded	Recorded

APPENDIX THREE FIELD SURVEY RESULTS

Table 24: Flora inventory (site x species) for all quadrats in the survey area

Family	Species	Naturalised	Cons. Code	MC048	MC050	MC053	MC059	MC066	MC072	MC108	MC110	MC121	MC122	MC129	MC153	MC012	MC051	MC130	MC131	MC20OP01	MC20Q13	MC20Q16	MC20Q17	RC415	MC20Q22	MC20Q23	MC20Q25	MC20OP03	MC20Q05	MC20Q19
	Vegetation type			AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AoTl	AoTl	AoTl	AsTe	AsTe	AsTe
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*																													
Acanthaceae	*Rostellularia adscendens* var. *latifolia*		P3																											
Aizoaceae	*Trianthema triquetra*																													
Aizoaceae	*Trianthema triquetrum*												X																	
Aizoaceae	*Zaleya galericulata* subsp. *galericulata*																													
Amaranthaceae	*Achyranthes aspera*																													
Amaranthaceae	*Aerva javanica*	*																												
Amaranthaceae	*Alternanthera angustifolia*																													
Amaranthaceae	*Alternanthera nana*																													
Amaranthaceae	*Alternanthera nodiflora*																						X					
Amaranthaceae	*Amaranthus cuspidifolius*																													
Amaranthaceae	*Amaranthus undulatus*							X									X		X					X						
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*																													
Amaranthaceae	*Gomphrena cunninghamii*							X								X	X	X	X					X						X
Amaranthaceae	*Ptilotus aervoides*																X					X								
Amaranthaceae	*Ptilotus astrolasius*													X				X		X	X									
Amaranthaceae	*Ptilotus auriculifolius*															X	X							X						
Amaranthaceae	*Ptilotus axillaris*																													
Amaranthaceae	*Ptilotus calostachyus*																			X								X		X
Amaranthaceae	*Ptilotus clementii*																			X				X						
Amaranthaceae	*Ptilotus exaltatus*														X					X										X
Amaranthaceae	*Ptilotus fusiformis*																							X						
Amaranthaceae	*Ptilotus helipteroides*																		X											
Amaranthaceae	*Ptilotus incanus*																													
Amaranthaceae	*Ptilotus mollis*		P4																											
Amaranthaceae	*Ptilotus obovatus*																													
Apocynaceae	*Calotropis procera*	*																												
Apocynaceae	*Carissa lanceolata*															X														
Apocynaceae	*Marsdenia angustata*																													
Araliaceae	*Trachymene oleracea* subsp. *oleracea*							X										X						X						
Asteraceae	*Calocephalus beardii*																													
Asteraceae	*Calocephalus knappii*																													
Asteraceae	*Centipeda minima* subsp. *macrocephala*																													
Asteraceae	*Flaveria trinervia*	*																												
Asteraceae	*Minuria integerrima*																													
Asteraceae	*Pentalepis trichodesmoides* subsp. *trichodesmoides*												X						X					X						
Asteraceae	*Peripleura virgata*																													
Asteraceae	*Pluchea dentex*																X								X					
Asteraceae	*Pluchea ferdinandi-muelleri*																								X	X				
Asteraceae	*Pluchea rubelliflora*																								X					
Asteraceae	*Pluchea tetranthera*																													
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*																													
Asteraceae	*Pterocaulon sphacelatum*																													
Asteraceae	*Pterocaulon sphaeranthoides*															X		X												
Asteraceae	*Sonchus oleraceus*	*																												
Asteraceae	*Streptoglossa bubakii*																X	X												
Asteraceae	*Streptoglossa liatroides*																													
Asteraceae	*Streptoglossa* sp.													X		X														
Boraginaceae	*Ehretia saligna var. saligna*																													
Boraginaceae	*Heliotropium chrysocarpum*						X																							
Boraginaceae	*Heliotropium crispatum*																							X						
Boraginaceae	*Heliotropium cunninghamii*									X						X						X								
Boraginaceae	*Heliotropium heteranthum*																X													
Boraginaceae	*Heliotropium inexplicitum*																		X											
Boraginaceae	*Heliotropium pachyphyllum*																													
Boraginaceae	*Heliotropium skeleton*																													
Boraginaceae	*Heliotropium* sp.																													
Boraginaceae	*Heliotropium tenuifolium*																							X						X
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*							X	X	X						X		X	X					X						
Campanulaceae	*Wahlenbergia tumidifructa*																													
Capparaceae	*Capparis spinosa* var. *nummularia*																													
Caryophyllaceae	*Polycarpaea corymbosa*				X												X	X	X											
Caryophyllaceae	*Polycarpaea holtzei*				X			X			X		X		X		X	X	X					X						
Caryophyllaceae	*Polycarpaea longiflora*						X	X			X							X	X		X		X							
Celastraceae	*Stackhousia intermedia*																													
Celastraceae	*Stackhousia muricata*																													
Chenopodiaceae	*Dysphania plantaginella*																													
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*																X	X	X											
Chenopodiaceae	*Dysphania sphaerosperma*													X																
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*																													
Chenopodiaceae	*Maireana sp.*																													
Chenopodiaceae	*Rhagodia eremaea*																	X			X									
Chenopodiaceae	*Salsola australis*													X			X													
Chenopodiaceae	*Sclerolaena cornishiana*																		X	X										
Chenopodiaceae	*Sclerolaena costata*																X													
Cleomaceae	*Cleome viscosa*				X			X		X				X		X	X	X		X	X	X	X	X				X	X	X
Convolvulaceae	*Bonamia erecta*																													
Convolvulaceae	*Bonamia pilbarensis*																					X	X	X						
Convolvulaceae	*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)						X		X	X	X		X				X	X	X											
Convolvulaceae	*Duperreya commixta*																													
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*																					X								
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*				X			X							X	X	X	X	X	X	X		X							X
Convolvulaceae	*Ipomoea muelleri*																													
Convolvulaceae	*Ipomoea* sp.																													
Convolvulaceae	*Operculina aequisepala*																													
Convolvulaceae	*Polymeria ambigua*													X		X										X				X
Cucurbitaceae	*Austrobryonia pilbarensis*																													
Cucurbitaceae	*Citrullus amarus*	*																												
Cucurbitaceae	*Cucumis melo*																													
Cucurbitaceae	*Cucumis variabilis*							X				X		X				X				X		X		X				
Cyperaceae	*Bulbostylis barbata*						X	X		X			X			X	X	X	X	X	X	X	X	X						X
Cyperaceae	*Bulbostylis turbinata*																								X	X	X			
Cyperaceae	*Cyperus bifax*																													
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*																													

Family	Species	MC057	MC146	MC147	MC148	MC150	MC152	MC20OP10	MC20OP11	MC20Q21	MC031	MC034	MC039	MC043	MC060	MC067	MC073	MC014	MC019	MC025	MC045	MC070	MC082	MC084	MC085	MC092	MC096	MC106	MC116
	Vegetation type	AsTl	AsTl	AsTl	AsTl	AsTl	AsTl	AtTe	AtTe	AtTe	CcaAiTe	CcaAiTe	CcaAiTe	CcaAiTe	ChAiTa	ChAiTa	ChAiTa	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*																												
Acanthaceae	*Rostellularia adscendens* var. *latifolia*																												
Aizoaceae	*Trianthema triquetra*																												
Aizoaceae	*Trianthema triquetrum*	X	X			X																							
Aizoaceae	*Zaleya galericulata* subsp. *galericulata*																X												
Amaranthaceae	*Achyranthes aspera*																												
Amaranthaceae	*Aerva javanica*																												
Amaranthaceae	*Alternanthera angustifolia*																												
Amaranthaceae	*Alternanthera nana*																												
Amaranthaceae	*Alternanthera nodiflora*																												
Amaranthaceae	*Amaranthus cuspidifolius*																												
Amaranthaceae	*Amaranthus undulatus*																									X		X	
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*																												
Amaranthaceae	*Gomphrena cunninghamii*	X		X		X	X													X					X	X		X	
Amaranthaceae	*Ptilotus aervoides*	X	X			X	X																						
Amaranthaceae	*Ptilotus astrolasius*					X																							
Amaranthaceae	*Ptilotus auriculifolius*																												
Amaranthaceae	*Ptilotus axillaris*																												
Amaranthaceae	*Ptilotus calostachyus*			X				X	X		X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	
Amaranthaceae	*Ptilotus clementii*																												
Amaranthaceae	*Ptilotus exaltatus*	X	X	X	X	X	X														X			X					
Amaranthaceae	*Ptilotus fusiformis*			X				X																	X				
Amaranthaceae	*Ptilotus helipteroides*				X																								
Amaranthaceae	*Ptilotus incanus*																												
Amaranthaceae	*Ptilotus mollis*																												
Amaranthaceae	*Ptilotus obovatus*																												
Apocynaceae	*Calotropis procera*																												
Apocynaceae	*Carissa lanceolata*	X	X	X	X	X	X																						
Apocynaceae	*Marsdenia angustata*																												
Araliaceae	*Trachymene oleracea* subsp. *oleracea*																												
Asteraceae	*Calocephalus beardii*																												
Asteraceae	*Calocephalus knappii*																												
Asteraceae	*Centipeda minima* subsp. *macrocephala*																												
Asteraceae	*Flaveria trinervia*																												
Asteraceae	*Minuria integerrima*		X																										
Asteraceae	*Pentalepis trichodesmoides* subsp. *trichodesmoides*																												
Asteraceae	*Peripleura virgata*																												
Asteraceae	*Pluchea dentex*							X		X																			
Asteraceae	*Pluchea ferdinandi-muelleri*					X									X						X								
Asteraceae	*Pluchea rubelliflora*																												
Asteraceae	*Pluchea tetranthera*	X	X			X	X								X						X	X							
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*																												
Asteraceae	*Pterocaulon sphacelatum*																												
Asteraceae	*Pterocaulon sphaeranthoides*																												
Asteraceae	*Sonchus oleraceus*																												
Asteraceae	*Streptoglossa bubakii*			X	X																								
Asteraceae	*Streptoglossa liatroides*		X			X	X																						
Asteraceae	*Streptoglossa* sp.	X		X																									
Boraginaceae	*Ehretia saligna var. saligna*																												
Boraginaceae	*Heliotropium chrysocarpum*							X	X	X					X														
Boraginaceae	*Heliotropium crispatum*																												
Boraginaceae	*Heliotropium cunninghamii*	X			X	X	X																					X	
Boraginaceae	*Heliotropium heteranthum*																												
Boraginaceae	*Heliotropium inexplicitum*																												
Boraginaceae	*Heliotropium pachyphyllum*																												
Boraginaceae	*Heliotropium skeleton*							X																					
Boraginaceae	*Heliotropium* sp.												X																
Boraginaceae	*Heliotropium tenuifolium*																			X									X
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*																												
Campanulaceae	*Wahlenbergia tumidifructa*																												
Capparaceae	*Capparis spinosa* var. *nummularia*																												
Caryophyllaceae	*Polycarpaea corymbosa*					X	X																						
Caryophyllaceae	*Polycarpaea holtzei*	X		X		X	X				X		X						X	X	X		X		X	X	X	X	X
Caryophyllaceae	*Polycarpaea longiflora*							X		X																		X	
Celastraceae	*Stackhousia intermedia*														X		X												
Celastraceae	*Stackhousia muricata*																												
Chenopodiaceae	*Dysphania plantaginella*																												
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*			X	X													X		X				X				X	
Chenopodiaceae	*Dysphania sphaerosperma*															X													
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*							X																					
Chenopodiaceae	*Maireana sp.*																							X					
Chenopodiaceae	*Rhagodia eremaea*																												
Chenopodiaceae	*Salsola australis*	X	X													X													
Chenopodiaceae	*Sclerolaena cornishiana*		X			X																							
Chenopodiaceae	*Sclerolaena costata*	X	X			X	X																						
Cleomaceae	*Cleome viscosa*	X	X				X																		X				
Convolvulaceae	*Bonamia erecta*							X	X	X																			
Convolvulaceae	*Bonamia pilbarensis*							X	X																				
Convolvulaceae	*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)			X				X				X	X	X				X		X	X		X	X	X	X	X	X	X
Convolvulaceae	*Duperreya commixta*																												
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*									X																			
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	X		X		X	X																		X			X	
Convolvulaceae	*Ipomoea muelleri*																												
Convolvulaceae	*Ipomoea* sp.																												
Convolvulaceae	*Operculina aequisepala*			X	X																								
Convolvulaceae	*Polymeria ambigua*									X														X				X	
Cucurbitaceae	*Austrobryonia pilbarensis*				X																								
Cucurbitaceae	*Citrullus amarus*																												
Cucurbitaceae	*Cucumis melo*				X																								
Cucurbitaceae	*Cucumis variabilis*																									X			
Cyperaceae	*Bulbostylis barbata*	X		X		X	X	X	X	X										X					X	X			
Cyperaceae	*Bulbostylis turbinata*																												
Cyperaceae	*Cyperus bifax*																												
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*																												

Family	Species	MC120	MC127	MC135	MC20OP04	MC20OP05	MC20OP08	MC20Q02	MC20Q03	MC20Q04	MC20Q08	MC20Q09	MC20Q14	MC20Q15	MC20Q18	MC20Q20	MC20Q26	MC081	MC094	MC097	MC109	MC20Q01	MC003	MC004	MC013	MC017	MC021	MC032	MC035
	Vegetation type	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*																												
Acanthaceae	*Rostellularia adscendens* var. *latifolia*																												
Aizoaceae	*Trianthema triquetra*																												
Aizoaceae	*Trianthema triquetrum*																		X										
Aizoaceae	*Zaleya galericulata* subsp. *galericulata*																												
Amaranthaceae	*Achyranthes aspera*																												
Amaranthaceae	*Aerva javanica*			X																									
Amaranthaceae	*Alternanthera angustifolia*																												
Amaranthaceae	*Alternanthera nana*																												
Amaranthaceae	*Alternanthera nodiflora*																												
Amaranthaceae	*Amaranthus cuspidifolius*																												
Amaranthaceae	*Amaranthus undulatus*																												
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*																												
Amaranthaceae	*Gomphrena cunninghamii*			X																							X		X
Amaranthaceae	*Ptilotus aervoides*																												
Amaranthaceae	*Ptilotus astrolasius*		X				X														X								
Amaranthaceae	*Ptilotus auriculifolius*			X																									
Amaranthaceae	*Ptilotus axillaris*																		X										
Amaranthaceae	*Ptilotus calostachyus*	X	X	X	X	X	X							X	X		X		X			X	X	X	X	X	X	X	X
Amaranthaceae	*Ptilotus clementii*																		X										
Amaranthaceae	*Ptilotus exaltatus*			X					X		X							X											
Amaranthaceae	*Ptilotus fusiformis*																												
Amaranthaceae	*Ptilotus helipteroides*																												
Amaranthaceae	*Ptilotus incanus*																										X		X
Amaranthaceae	*Ptilotus mollis*																												
Amaranthaceae	*Ptilotus obovatus*																												
Apocynaceae	*Calotropis procera*																												
Apocynaceae	*Carissa lanceolata*			X														X									X		X
Apocynaceae	*Marsdenia angustata*							X																					
Araliaceae	*Trachymene oleracea* subsp. *oleracea*																												
Asteraceae	*Calocephalus beardii*																												
Asteraceae	*Calocephalus knappii*																												
Asteraceae	*Centipeda minima* subsp. *macrocephala*																												
Asteraceae	*Flaveria trinervia*																												
Asteraceae	*Minuria integerrima*																												
Asteraceae	*Pentalepis trichodesmoides* subsp. *trichodesmoides*																												
Asteraceae	*Peripleura virgata*																												
Asteraceae	*Pluchea dentex*																												
Asteraceae	*Pluchea ferdinandi-muelleri*			X																									
Asteraceae	*Pluchea rubelliflora*																												
Asteraceae	*Pluchea tetranthera*				X																	X							
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*																												
Asteraceae	*Pterocaulon sphacelatum*																												
Asteraceae	*Pterocaulon sphaeranthoides*																												
Asteraceae	*Sonchus oleraceus*																												
Asteraceae	*Streptoglossa bubakii*																												
Asteraceae	*Streptoglossa liatroides*																												
Asteraceae	*Streptoglossa* sp.																												
Boraginaceae	*Ehretia saligna var. saligna*																										X		X
Boraginaceae	*Heliotropium chrysocarpum*							X		X									X										
Boraginaceae	*Heliotropium crispatum*																												
Boraginaceae	*Heliotropium cunninghamii*														X				X			X							
Boraginaceae	*Heliotropium heteranthum*																												
Boraginaceae	*Heliotropium inexplicitum*													X															
Boraginaceae	*Heliotropium pachyphyllum*																		X	X									
Boraginaceae	*Heliotropium skeleton*																								X				
Boraginaceae	*Heliotropium* sp.																								X				
Boraginaceae	*Heliotropium tenuifolium*	X					X	X	X		X																		
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*			X			X	X																			X		
Campanulaceae	*Wahlenbergia tumidifructa*																												
Capparaceae	*Capparis spinosa* var. *nummularia*																												
Caryophyllaceae	*Polycarpaea corymbosa*																			X		X							
Caryophyllaceae	*Polycarpaea holtzei*	X		X										X									X	X			X	X	
Caryophyllaceae	*Polycarpaea longiflora*			X										X															
Celastraceae	*Stackhousia intermedia*																		X										
Celastraceae	*Stackhousia muricata*																			X									
Chenopodiaceae	*Dysphania plantaginella*																												
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*																												
Chenopodiaceae	*Dysphania sphaerosperma*																												
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*																												
Chenopodiaceae	*Maireana sp.*																												
Chenopodiaceae	*Rhagodia eremaea*																												
Chenopodiaceae	*Salsola australis*																		X										
Chenopodiaceae	*Sclerolaena cornishiana*																												
Chenopodiaceae	*Sclerolaena costata*																												
Cleomaceae	*Cleome viscosa*																										X		
Convolvulaceae	*Bonamia erecta*																												
Convolvulaceae	*Bonamia pilbarensis*																												
Convolvulaceae	*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)	X	X	X	X	X	X				X			X	X			X	X	X	X	X	X	X	X	X	X	X	X
Convolvulaceae	*Duperreya commixta*																										X		
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*																X												
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*			X			X	X	X	X	X	X	X	X	X	X	X		X										X
Convolvulaceae	*Ipomoea muelleri*																												
Convolvulaceae	*Ipomoea* sp.																												
Convolvulaceae	*Operculina aequisepala*																												
Convolvulaceae	*Polymeria ambigua*						X												X	X									
Cucurbitaceae	*Austrobryonia pilbarensis*																												
Cucurbitaceae	*Citrullus amarus*																												
Cucurbitaceae	*Cucumis melo*																												
Cucurbitaceae	*Cucumis variabilis*			X				X					X																
Cyperaceae	*Bulbostylis barbata*								X		X	X	X	X	X					X		X							
Cyperaceae	*Bulbostylis turbinata*																												
Cyperaceae	*Cyperus bifax*																												
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*																						X			X		X

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type			AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AoTl	AoTl	AoTl
Family	Species	Naturalised	Cons. Code	MC048	MC050	MC053	MC059	MC066	MC072	MC108	MC110	MC121	MC122	MC129	MC153	MC012	MC051	MC130	MC131	MC20OP01	MC20Q13	MC20Q16	MC20Q17	RC415	MC20Q22	MC20Q23	MC20Q25
Cyperaceae	*Cyperus difformis*																										
Cyperaceae	*Cyperus iria*																										
Cyperaceae	*Cyperus ixiocarpus*																										
Cyperaceae	*Cyperus squarrosus*																								X		
Cyperaceae	*Cyperus vaginatus*																										
Cyperaceae	*Fimbristylis dichotoma*					X										X	X	X	X	X	X	X	X		X	X	X
Cyperaceae	*Fimbristylis microcarya*																										
Cyperaceae	*Fimbristylis simulans*										X	X								X							
Cyperaceae	*Schoenoplectiella laevis*																										
Cyperaceae	*Schoenoplectus subulatus*																										
Elatinaceae	*Bergia pedicellaris*																										
Euphorbiaceae	*Adriana tomentosa var. tomentosa*																										
Euphorbiaceae	*Euphorbia alsiniflora*																										
Euphorbiaceae	*Euphorbia australis*				X			X				X		X		X	X	X	X			X	X				
Euphorbiaceae	*Euphorbia biconvexa*																										
Euphorbiaceae	*Euphorbia boophthona*																X							X			
Euphorbiaceae	*Euphorbia careyi*																										
Euphorbiaceae	*Euphorbia hirta*	*																									
Euphorbiaceae	*Euphorbia schultzii*								X																		
Euphorbiaceae	*Euphorbia* sp.																								X	X	
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*							X											X					X			
Euphorbiaceae	*Euphorbia trigonosperma*				X			X						X		X	X	X									
Fabaceae	*Acacia acradenia*						X							X													
Fabaceae	*Acacia adoxa var. adoxa*																										
Fabaceae	*Acacia adsurgens*																										
Fabaceae	*Acacia ampliceps*																										
Fabaceae	*Acacia ancistrocarpa*																										
Fabaceae	*Acacia aphanoclada*		P1																								
Fabaceae	*Acacia aphanoclada x pyrifolia* var. *pyrifolia*																										
Fabaceae	*Acacia bivenosa*					X		X		X		X		X	X	X		X		X		X			X	X	X
Fabaceae	*Acacia colei* var. *colei*																										
Fabaceae	*Acacia coriacea* subsp. *pendens*																										
Fabaceae	*Acacia eriopoda*																										X
Fabaceae	*Acacia holosericea*																										
Fabaceae	*Acacia inaequilatera*			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Fabaceae	*Acacia maitlandii*																										
Fabaceae	*Acacia monticola*																								X	X	X
Fabaceae	*Acacia orthocarpa*						X			X	X			X				X	X			X			X	X	X
Fabaceae	*Acacia pruinocarpa*																										
Fabaceae	*Acacia ptychophylla*																										
Fabaceae	*Acacia pyrifolia* agg.							X			X	X		X							X						
Fabaceae	*Acacia retivenea* subsp. *clandestina*																										
Fabaceae	*Acacia* sp.																										
Fabaceae	*Acacia synchronicia*													X	X	X	X			X	X						
Fabaceae	*Acacia tenuissima*																										
Fabaceae	*Acacia trachycarpa*													X		X											
Fabaceae	*Acacia trachycarpa x tumida* var. *pilbarensis*																										
Fabaceae	*Acacia tumida* var. *pilbarensis*																X										
Fabaceae	*Aeschynomene indica*																										
Fabaceae	*Alysicarpus muelleri*															X			X						X	X	X
Fabaceae	*Crotalaria medicaginea* var. *neglecta*				X			X	X	X				X			X	X	X			X					
Fabaceae	*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*																							X			
Fabaceae	*Crotalaria* sp.																										
Fabaceae	*Cullen graveolens*																										
Fabaceae	*Cullen leucanthum*																										
Fabaceae	*Cullen leucochaites*																										
Fabaceae	*Desmodium muelleri*																										
Fabaceae	*Gastrolobium grandiflorum*																										
Fabaceae	*Glycine canescens*																										
Fabaceae	*Gompholobium oreophilum*																										
Fabaceae	*Indigastrum parviflorum*																										
Fabaceae	*Indigofera colutea*				X											X	X					X			X		
Fabaceae	*Indigofera linifolia*				X																				X		X
Fabaceae	*Indigofera linnaei*																							X	X		
Fabaceae	*Indigofera monophylla*						X			X	X	X	X	X					X	X	X	X		X		X	
Fabaceae	*Indigofera rugosa*										X																
Fabaceae	*Indigofera* sp.																										
Fabaceae	*Indigofera trita* subsp. *trita*							X																X			
Fabaceae	*Isotropis atropurpurea*																										
Fabaceae	*Neptunia dimorphantha*																										
Fabaceae	*Petalostylis labicheoides*																										
Fabaceae	*Rhynchosia minima*				X			X	X					X	X	X	X	X		X	X	X	X	X	X	X	X
Fabaceae	*Senna artemisioides* subsp. *helmsii*															X	X							X	X	X	
Fabaceae	*Senna artemisioides* subsp. *oligophylla*					X	X			X	X		X	X		X			X		X	X		X		X	
Fabaceae	*Senna artemisioides* subsp. *oligophylla x helmsii*																										
Fabaceae	*Senna glutinosa* subsp. *glutinosa*			X		X		X		X	X	X		X	X	X		X	X					X		X	X
Fabaceae	*Senna glutinosa* subsp. *glutinosa x luerssenii*																X	X		X	X	X		X		X	
Fabaceae	*Senna glutinosa* subsp. *pruinosa*			X			X										X	X	X	X			X				
Fabaceae	*Senna notabilis*																X							X			
Fabaceae	*Senna symonii*			X	X	X	X		X		X	X		X	X			X								X	X
Fabaceae	*Senna venusta*																							X			
Fabaceae	*Sesbania cannabina*																										
Fabaceae	*Swainsona decurrens*				X	X		X	X				X	X	X		X	X									
Fabaceae	*Swainsona formosa*									X																	
Fabaceae	*Swainsona stenodonta*									X				X		X		X									
Fabaceae	*Tephrosia clementii*																										
Fabaceae	*Tephrosia densa*								X																		
Fabaceae	*Tephrosia rosea* var. *clementii*																					X					
Fabaceae	*Tephrosia* sp.																						X				
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 1161)		P3																					X			
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 356)			X			X		X		X	X															
Fabaceae	*Tephrosia virens*																										
Fabaceae	*Vachellia farnesiana*	*																									
Fabaceae	*Vigna lanceolata* var. *lanceolata*																										

	Vegetation type	AsTe	AsTe	AsTe	AsTl	AsTl	AsTl	AsTl	AsTl	AsTl	AtTe	AtTe	AtTe	CcaAiTe	CcaAiTe	CcaAiTe	CcaAiTe	ChAiTa	ChAiTa	ChAiTa	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe
Family	Species	MC20OP03	MC20Q05	MC20Q19	MC057	MC146	MC147	MC148	MC150	MC152	MC20OP10	MC20OP11	MC20Q21	MC031	MC034	MC039	MC043	MC060	MC067	MC073	MC014	MC019	MC025	MC045	MC070	MC082	MC084	MC085	MC092
Cyperaceae	*Cyperus difformis*																												
Cyperaceae	*Cyperus iria*						X																						
Cyperaceae	*Cyperus ixiocarpus*																												
Cyperaceae	*Cyperus squarrosus*																												
Cyperaceae	*Cyperus vaginatus*																												
Cyperaceae	*Fimbristylis dichotoma*				X				X		X	X	X								X	X	X				X		
Cyperaceae	*Fimbristylis microcarya*												X																
Cyperaceae	*Fimbristylis simulans*						X				X	X		X	X	X	X				X	X				X	X		
Cyperaceae	*Schoenoplectiella laevis*																												
Cyperaceae	*Schoenoplectus subulatus*																												
Elatinaceae	*Bergia pedicellaris*						X																						
Euphorbiaceae	*Adriana tomentosa var. tomentosa*																												
Euphorbiaceae	*Euphorbia alsiniflora*																												
Euphorbiaceae	*Euphorbia australis*				X			X	X	X											X								
Euphorbiaceae	*Euphorbia biconvexa*																												
Euphorbiaceae	*Euphorbia boophthona*						X	X																					
Euphorbiaceae	*Euphorbia careyi*																												
Euphorbiaceae	*Euphorbia hirta*																												
Euphorbiaceae	*Euphorbia schultzii*																						X						
Euphorbiaceae	*Euphorbia* sp.	X																											
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*								X																				X
Euphorbiaceae	*Euphorbia trigonosperma*					X	X	X	X	X																			
Fabaceae	*Acacia acradenia*	X	X																										
Fabaceae	*Acacia adoxa var. adoxa*											X																	
Fabaceae	*Acacia adsurgens*																												
Fabaceae	*Acacia ampliceps*																												
Fabaceae	*Acacia ancistrocarpa*																												
Fabaceae	*Acacia aphanoclada*																												
Fabaceae	*Acacia aphanoclada x pyrifolia* var. *pyrifolia*			X																									
Fabaceae	*Acacia bivenosa*	X	X				X	X	X	X	X		X					X	X		X		X	X	X	X	X		X
Fabaceae	*Acacia colei* var. *colei*																												
Fabaceae	*Acacia coriacea* subsp. *pendens*																												
Fabaceae	*Acacia eriopoda*																												
Fabaceae	*Acacia holosericea*																												
Fabaceae	*Acacia inaequilatera*	X	X	X	X				X	X							X		X	X		X	X	X	X		X	X	X
Fabaceae	*Acacia maitlandii*															X													
Fabaceae	*Acacia monticola*																					X		X	X				
Fabaceae	*Acacia orthocarpa*														X							X	X			X		X	X
Fabaceae	*Acacia pruinocarpa*																								X				
Fabaceae	*Acacia ptychophylla*						X				X	X			X	X	X				X	X							
Fabaceae	*Acacia pyrifolia* agg.																	X							X			X	
Fabaceae	*Acacia retivenea* subsp. *clandestina*																												
Fabaceae	*Acacia* sp.										X	X	X													X			
Fabaceae	*Acacia synchronicia*	X	X		X	X	X	X	X	X										X				X	X		X		
Fabaceae	*Acacia tenuissima*																												
Fabaceae	*Acacia trachycarpa*											X	X															X	
Fabaceae	*Acacia trachycarpa x tumida* var. *pilbarensis*																												
Fabaceae	*Acacia tumida* var. *pilbarensis*																					X							
Fabaceae	*Aeschynomene indica*																												
Fabaceae	*Alysicarpus muelleri*									X																			
Fabaceae	*Crotalaria medicaginea* var. *neglecta*				X		X	X		X																			
Fabaceae	*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*																												
Fabaceae	*Crotalaria* sp.																												
Fabaceae	*Cullen graveolens*							X																					
Fabaceae	*Cullen leucanthum*																												
Fabaceae	*Cullen leucochaites*																												
Fabaceae	*Desmodium muelleri*							X																					
Fabaceae	*Gastrolobium grandiflorum*																												
Fabaceae	*Glycine canescens*																												
Fabaceae	*Gompholobium oreophilum*																												
Fabaceae	*Indigastrum parviflorum*				X																								
Fabaceae	*Indigofera colutea*									X																			X
Fabaceae	*Indigofera linifolia*																			X									
Fabaceae	*Indigofera linnaei*																												
Fabaceae	*Indigofera monophylla*	X	X				X		X	X	X	X	X									X	X					X	X
Fabaceae	*Indigofera rugosa*																												X
Fabaceae	*Indigofera* sp.																												
Fabaceae	*Indigofera trita* subsp. *trita*																												
Fabaceae	*Isotropis atropurpurea*																												
Fabaceae	*Neptunia dimorphantha*						X	X	X	X																			
Fabaceae	*Petalostylis labicheoides*																												
Fabaceae	*Rhynchosia minima*	X			X	X	X	X	X	X																			
Fabaceae	*Senna artemisioides* subsp. *helmsii*				X		X		X																				
Fabaceae	*Senna artemisioides* subsp. *oligophylla*				X	X	X	X		X																			
Fabaceae	*Senna artemisioides* subsp. *oligophylla x helmsii*		X																										
Fabaceae	*Senna glutinosa* subsp. *glutinosa*			X			X			X				X	X						X	X	X	X	X		X	X	X
Fabaceae	*Senna glutinosa* subsp. *glutinosa x luerssenii*	X	X	X				X	X	X	X			X		X	X								X				
Fabaceae	*Senna glutinosa* subsp. *pruinosa*		X	X							X										X		X				X		
Fabaceae	*Senna notabilis*						X	X		X	X		X																
Fabaceae	*Senna symonii*	X		X			X	X	X	X	X			X	X	X		X		X	X	X		X	X		X		
Fabaceae	*Senna venusta*																												
Fabaceae	*Sesbania cannabina*																												
Fabaceae	*Swainsona decurrens*				X														X	X									
Fabaceae	*Swainsona formosa*																												
Fabaceae	*Swainsona stenodonta*				X					X								X	X	X									
Fabaceae	*Tephrosia clementii*																												
Fabaceae	*Tephrosia densa*																												
Fabaceae	*Tephrosia rosea* var. *clementii*																												
Fabaceae	*Tephrosia* sp.																												
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 1161)									X																			
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 356)										X												X	X				X	X
Fabaceae	*Tephrosia virens*																												
Fabaceae	*Vachellia farnesiana*																												
Fabaceae	*Vigna lanceolata* var. *lanceolata*																												

	Vegetation type	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe
Family	Species	MC096	MC106	MC116	MC120	MC127	MC135	MC20OP04	MC20OP05	MC20OP08	MC20Q02	MC20Q03	MC20Q04	MC20Q08	MC20Q09	MC20Q14	MC20Q15	MC20Q18	MC20Q20	MC20Q26	MC081	MC094	MC097	MC109	MC20Q01	MC003	MC004	MC013	MC017	MC021	MC032	MC035
Cyperaceae	*Cyperus difformis*																															
Cyperaceae	*Cyperus iria*																															
Cyperaceae	*Cyperus ixiocarpus*																															
Cyperaceae	*Cyperus squarrosus*																															
Cyperaceae	*Cyperus vaginatus*																															
Cyperaceae	*Fimbristylis dichotoma*	X	X	X				X	X			X		X	X		X			X												
Cyperaceae	*Fimbristylis microcarya*																															
Cyperaceae	*Fimbristylis simulans*	X	X		X		X	X	X	X								X								X	X	X	X	X		X
Cyperaceae	*Schoenoplectiella laevis*																															
Cyperaceae	*Schoenoplectus subulatus*																															
Elatinaceae	*Bergia pedicellaris*																															
Euphorbiaceae	*Adriana tomentosa var. tomentosa*																															
Euphorbiaceae	*Euphorbia alsiniflora*																															
Euphorbiaceae	*Euphorbia australis*		X				X														X											
Euphorbiaceae	*Euphorbia biconvexa*																															
Euphorbiaceae	*Euphorbia boophthona*																															
Euphorbiaceae	*Euphorbia careyi*										X					X																
Euphorbiaceae	*Euphorbia hirta*																															
Euphorbiaceae	*Euphorbia schultzii*				X																											
Euphorbiaceae	*Euphorbia* sp.																															
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*																															
Euphorbiaceae	*Euphorbia trigonosperma*																													X		
Fabaceae	*Acacia acradenia*						X			X			X					X														
Fabaceae	*Acacia adoxa var. adoxa*																															
Fabaceae	*Acacia adsurgens*	X																														
Fabaceae	*Acacia ampliceps*																															
Fabaceae	*Acacia ancistrocarpa*															X						X										
Fabaceae	*Acacia aphanoclada*																															
Fabaceae	*Acacia aphanoclada x pyrifolia* var. *pyrifolia*																															
Fabaceae	*Acacia bivenosa*	X		X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X		X
Fabaceae	*Acacia colei* var. *colei*																															
Fabaceae	*Acacia coriacea* subsp. *pendens*																															
Fabaceae	*Acacia eriopoda*																					X				X					X	
Fabaceae	*Acacia holosericea*	X																														
Fabaceae	*Acacia inaequilatera*	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X							X
Fabaceae	*Acacia maitlandii*																															
Fabaceae	*Acacia monticola*							X																		X	X		X	X		X
Fabaceae	*Acacia orthocarpa*	X	X							X	X					X		X														
Fabaceae	*Acacia pruinocarpa*																															X
Fabaceae	*Acacia ptychophylla*				X			X	X	X							X		X	X						X	X	X		X		X
Fabaceae	*Acacia pyrifolia* agg.				X	X	X	X	X	X	X		X				X	X		X								X	X	X		
Fabaceae	*Acacia retivenea* subsp. *clandestina*																															
Fabaceae	*Acacia* sp.																															
Fabaceae	*Acacia synchronicia*					X																										
Fabaceae	*Acacia tenuissima*																															
Fabaceae	*Acacia trachycarpa*																					X	X									
Fabaceae	*Acacia trachycarpa x tumida* var. *pilbarensis*																															
Fabaceae	*Acacia tumida* var. *pilbarensis*						X																				X	X	X	X	X	X
Fabaceae	*Aeschynomene indica*																															
Fabaceae	*Alysicarpus muelleri*														X																	
Fabaceae	*Crotalaria medicaginea* var. *neglecta*						X															X										
Fabaceae	*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*																															
Fabaceae	*Crotalaria* sp.																															
Fabaceae	*Cullen graveolens*																															
Fabaceae	*Cullen leucanthum*																															
Fabaceae	*Cullen leucochaites*																															
Fabaceae	*Desmodium muelleri*																															
Fabaceae	*Gastrolobium grandiflorum*																													X		
Fabaceae	*Glycine canescens*																															
Fabaceae	*Gompholobium oreophilum*																									X	X	X	X		X	X
Fabaceae	*Indigastrum parviflorum*																															
Fabaceae	*Indigofera colutea*																															
Fabaceae	*Indigofera linifolia*																															
Fabaceae	*Indigofera linnaei*																															
Fabaceae	*Indigofera monophylla*		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X
Fabaceae	*Indigofera rugosa*																															
Fabaceae	*Indigofera* sp.																															
Fabaceae	*Indigofera trita* subsp. *trita*																															
Fabaceae	*Isotropis atropurpurea*	X									X												X					X		X		
Fabaceae	*Neptunia dimorphantha*																															
Fabaceae	*Petalostylis labicheoides*											X																				
Fabaceae	*Rhynchosia minima*						X													X												
Fabaceae	*Senna artemisioides* subsp. *helmsii*																	X														
Fabaceae	*Senna artemisioides* subsp. *oligophylla*	X					X																	X								
Fabaceae	*Senna artemisioides* subsp. *oligophylla x helmsii*											X																				
Fabaceae	*Senna glutinosa* subsp. *glutinosa*	X	X	X	X	X	X	X	X	X	X			X	X		X			X		X	X		X		X	X	X	X		X
Fabaceae	*Senna glutinosa* subsp. *glutinosa x luerssenii*																X	X	X	X		X										
Fabaceae	*Senna glutinosa* subsp. *pruinosa*	X	X						X	X							X	X										X				
Fabaceae	*Senna notabilis*						X																									
Fabaceae	*Senna symonii*	X	X		X			X				X	X	X						X	X	X					X	X	X	X		X
Fabaceae	*Senna venusta*																															
Fabaceae	*Sesbania cannabina*																															
Fabaceae	*Swainsona decurrens*					X	X																									
Fabaceae	*Swainsona formosa*																															
Fabaceae	*Swainsona stenodonta*					X															X											
Fabaceae	*Tephrosia clementii*																															
Fabaceae	*Tephrosia densa*																															
Fabaceae	*Tephrosia rosea* var. *clementii*																									X						
Fabaceae	*Tephrosia* sp.																															
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 1161)																															
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 356)			X				X			X			X			X		X	X		X										X
Fabaceae	*Tephrosia virens*																											X	X	X		
Fabaceae	*Vachellia farnesiana*																															
Fabaceae	*Vigna lanceolata* var. *lanceolata*																															

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type			AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AoTl	AoTl	AoTl	AsTe	AsTe	AsTe	AsTl	AsTl	AsTl	AsTl	AsTl	AsTl	AtTe	AtTe	AtTe	CcaAiTe	CcaAiTe	CcaAiTe	CcaAiTe	ChAiTa	ChAiTa	ChAiTa	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe
Family	**Species**	**Naturalised**	**Cons. Code**	**MC048**	**MC050**	**MC053**	**MC059**	**MC066**	**MC072**	**MC108**	**MC110**	**MC121**	**MC122**	**MC129**	**MC153**	**MC012**	**MC051**	**MC130**	**MC131**	**MC20OP01**	**MC20Q13**	**MC20Q16**	**MC20Q17**	**RC415**	**MC20Q22**	**MC20Q23**	**MC20Q25**	**MC20OP03**	**MC20Q05**	**MC20Q19**	**MC057**	**MC146**	**MC147**	**MC148**	**MC150**	**MC152**	**MC20OP10**	**MC20OP11**	**MC20Q21**	**MC031**	**MC034**	**MC039**	**MC043**	**MC060**	**MC067**	**MC073**	**MC014**	**MC019**	**MC025**	**MC045**	**MC070**	**MC082**	**MC084**	**MC085**	**MC092**	**MC096**	**MC106**	**MC116**	**MC120**	**MC127**	**MC135**	**MC20OP04**	**MC20OP05**	**MC20OP08**	**MC20Q02**	**MC20Q03**	**MC20Q04**	**MC20Q08**	**MC20Q09**	**MC20Q14**	**MC20Q15**	**MC20Q18**	**MC20Q20**	**MC20Q26**	**MC081**	**MC094**	**MC097**	**MC109**	**MC20Q01**	**MC003**	**MC004**	**MC013**	**MC017**	**MC021**	**MC032**	**MC035**
Goodeniaceae	*Dampiera candicans*																																X				X				X	X	X					X	X			X		X	X	X			X		X		X	X								X								X	X	X	X	X		X
Goodeniaceae	*Goodenia cusackiana*												X		X																						X																								X					X		X				X															
Goodeniaceae	*Goodenia lamprosperma*																																																																																						
Goodeniaceae	*Goodenia microptera*																				X	X	X			X	X									X	X		X																X			X											X											X	X	X									
Goodeniaceae	*Goodenia muelleriana*							X						X	X	X	X	X	X			X	X	X				X	X	X			X		X		X																										X											X														
Goodeniaceae	*Goodenia nuda*		P4																																																																																					
Goodeniaceae	*Goodenia stobbsiana*						X			X									X	X								X			X			X	X	X		X	X	X	X				X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X			X	X					X	X		X	X	X	X	X	X	X
Goodeniaceae	*Goodenia triodiophila*																									X						X													X												X	X			X																								
Goodeniaceae	*Scaevola amblyanthera* var. *centralis*													X																						X	X	X																										X			X													X	X								
Goodeniaceae	*Scaevola browniana* subsp. *browniana*																																																																																							
Goodeniaceae	*Scaevola spinescens*																				X	X	X																																																				X														
Haloragaceae	*Haloragis gossei*																																	X	X																																																							
Lamiaceae	*Clerodendrum floribundum*																																																																X																									
Lamiaceae	*Clerodendrum tomentosum* var. *lanceolatum*													X																																																																									X	X
Lauraceae	*Cassytha capillaris*																										X																																																					X										
Loranthaceae	*Amyema preissii*			X																																																																																				
Loranthaceae	*Amyema sanguinea* var. *sanguinea*																																																																																									
Lythraceae	*Ammannia baccifera*																																																																																								
Lythraceae	*Ammannia multiflora*																																																																																								
Malvaceae	*Abutilon fraseri*																							X																																																																	
Malvaceae	*Abutilon lepidum*																X		X													X				X	X																					X																											X		
Malvaceae	*Abutilon macrum*																																																																																							
Malvaceae	*Abutilon malvifolium*																																X		X																																																					
Malvaceae	*Abutilon oxycarpum* subsp. Prostrate (A.A. Mitchell PRP 1266)																																			X	X																																																				
Malvaceae	*Abutilon* sp.																																																																																								
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)																	X																																																																							
Malvaceae	*Androcalva luteiflora*																																																																																								
Malvaceae	*Corchorus crozophorifolius*																					X																																																																			
Malvaceae	*Corchorus lasiocarpus* subsp. *lasiocarpus*				X				X					X	X		X	X	X	X	X		X			X							X			X	X	X																								X																													
Malvaceae	*Corchorus parviflorus*				X		X			X	X					X								X		X	X	X	X	X			X	X			X	X											X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X	X
Malvaceae	*Corchorus* sp.															X																																																																									
Malvaceae	*Corchorus tridens*																								X									X	X	X																																																				
Malvaceae	*Gossypium australe*				X		X					X	X	X	X	X	X	X	X		X	X	X	X			X	X	X	X			X		X	X																			X	X	X						X								X		X	X		X		X	X									
Malvaceae	*Gossypium robinsonii*																																																		X																																				X		
Malvaceae	*Hibiscus austrinus* var. *austrinus*																																																																																									
Malvaceae	*Hibiscus coatesii*																X							X				X									X											X	X					X		X		X	X	X							X			X																X
Malvaceae	*Hibiscus goldsworthii*																																																																																							
Malvaceae	*Hibiscus leptocladus*																																																																																							
Malvaceae	*Hibiscus* sp.																																																																																							
Malvaceae	*Hibiscus sturtii* agg.				X							X				X	X	X		X	X	X							X	X		X	X		X	X		X	X											X		X	X									X	X	X	X		X			X			X		X	X	X		X	X			X	X	X
Malvaceae	*Malvastrum americanum*	*																				X										X																																																									
Malvaceae	*Melhania oblongifolia*							X																																																			X				X																					X		
Malvaceae	*Seringia nephrosperma*																																							X	X																																							X					X	
Malvaceae	*Seringia* sp.																																																																																							
Malvaceae	*Sida ?arenicola*																																																																																							
Malvaceae	*Sida ?macropoda* (complex)																																	X																																																				X		
Malvaceae	*Sida aff. fibulifera*																																		X																																																				
Malvaceae	*Sida clementii*													X																																																																									X
Malvaceae	*Sida echinocarpa*														X	X	X	X	X	X	X	X	X		X		X	X	X	X				X	X																		X													X		X			X	X	X		X								
Malvaceae	*Sida fibulifera*														X					X				X			X	X		X	X			X	X											X							X							X						X							X	X											
Malvaceae	*Sida macropoda*																																																																																							
Malvaceae	*Sida rohlenae* subsp. *rohlenae*																X														X																						X																																		X
Malvaceae	*Sida* sp. Articulation below (A.A. Mitchell PRP 165)																																										X																			X																			X	X	X	X	X	X	X
Malvaceae	*Sida* sp. Excedentifolia (J.L. Egan 1925)																																										X																				X																		X			X	X	
Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)													X													X	X									X	X												X	X	X		X	X	X					X		X		X	X		X			X	X		X		X			X	X	X						X
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/9)																							X																																																																	
Malvaceae	*Sida* sp. verrucose glands (F.H. Mollemans 2423)														X	X																																																																						
Malvaceae	*Triumfetta chaetocarpa*							X																																																																															
Malvaceae	*Triumfetta clementii*													X			X	X	X		X	X		X					X																																											X																
Malvaceae	*Triumfetta maconochieana*																X							X																										X						X				X																						X	X	X		X		X
Malvaceae	*Triumfetta propinqua*																							X																																											X																							
Malvaceae	*Waltheria indica*																																																																																								
Malvaceae	*Waltheria virgata*											X																																																			X				X																							
Marsileaceae	*Marsilea hirsuta*																																																																																							
Menispermaceae	*Tinospora smilacina*																																																																																				X		
Molluginaceae	*Trigastrotheca molluginea*						X										X	X	X	X	X	X		X				X		X			X		X	X	X	X				X	X				X	X	X	X			X	X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X			X	X	X		X	X				
Moraceae	*Ficus brachypoda*																																																																																							X
Myrtaceae	*Corymbia candida* subsp. *dipsodes*																																									X	X	X	X																																											
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*																																																																																								
Myrtaceae	*Corymbia ferriticola*																																										X							X																																				X			X		X
Myrtaceae	*Corymbia hamersleyana*						X						X	X	X							X					X		X													X				X		X		X	X			X		X		X	X		X		X	X	X	X	X	X	X	X			X			X		X	X	X	X	X	X	X			X	X	X
Myrtaceae	*Eucalyptus camaldulensis*																																																																																									
Myrtaceae	*Eucalyptus leucophloia* subsp. *leucophloia*																																	X								X	X						X			X	X	X	X			X			X			X	X			X		X						X							X	X	X	X		X
Myrtaceae	*Eucalyptus victrix*																																																																																								
Myrtaceae	*Melaleuca bracteata*																																																																																								
Myrtaceae	*Melaleuca glomerata*																																																																																								
Nyctaginaceae	*Boerhavia burbidgeana*																				X																																																																				
Nyctaginaceae	*Boerhavia coccinea*							X						X			X	X	X	X	X	X	X									X	X					X																		X																																		
Nyctaginaceae	*Boerhavia gardneri*						X										X							X					X																									X														X																				
Nyctaginaceae	*Boerhavia repleta*																																																																																								
Nyctaginaceae	*Boerhavia schomburgkiana*																															X																																																										
Oleaceae	*Jasminum didymum* subsp. *lineare*																																																																																					X		
Papavaceae	*Argemone ochroleuca*	*																																																																																								
Phyllanthaceae	*Notoleptopus decaisnei*							X						X																																																																											X
Phyllanthaceae	*Phyllanthus erwinii*															X																																																																									
Phyllanthaceae	*Phyllanthus maderaspatensis*													X																				X	X	X																			X								X																							X		
Plantaginaceae	*Stemodia grossa*																		X			X			X	X											X	X	X																																									X								
Poaceae	*Amphipogon sericeus*																																	X								X	X	X	X					X																																		X	X					
Poaceae	*Aristida contorta*				X	X				X					X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X										X					X	X			X				X							X					X	X			X						X	
Poaceae	*Aristida holathera* var. *holathera*																																																																													X		X									
Poaceae	*Aristida hygrometrica*																											X																																																														
Poaceae	*Aristida latifolia*																															X	X	X																																																							
Poaceae	*Bothriochloa ewartiana*																																																																																								
Poaceae	*Brachyachne convergens*																															X	X	X	X	X	X																																																				

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type			AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw1	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AiTw2	AoTl	AoTl	AoTl	AsTe	AsTe	AsTe	AsTl	AsTl	AsTl	AsTl	AsTl	AsTl	AtTe	AtTe	AtTe	CcaAiTe	CcaAiTe	CcaAiTe	CcaAiTe	ChAiTa	ChAiTa	ChAiTa	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTe	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAiTw	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChAmTe
Family	Species	Naturalised	Cons. Code	MC048	MC050	MC053	MC059	MC066	MC072	MC108	MC110	MC121	MC122	MC129	MC153	MC012	MC051	MC130	MC131	MC20OP01	MC20Q13	MC20Q16	MC20Q17	RC415	MC20Q22	MC20Q23	MC20Q25	MC20OP03	MC20Q05	MC20Q19	MC057	MC146	MC147	MC148	MC150	MC152	MC20OP10	MC20OP11	MC20Q21	MC031	MC034	MC039	MC043	MC060	MC067	MC073	MC014	MC019	MC025	MC045	MC070	MC082	MC084	MC085	MC092	MC096	MC106	MC116	MC120	MC127	MC135	MC20OP04	MC20OP05	MC20OP08	MC20Q02	MC20Q03	MC20Q04	MC20Q08	MC20Q09	MC20Q14	MC20Q15	MC20Q18	MC20Q20	MC20Q26	MC081	MC094	MC097	MC109	MC20Q01	MC003	MC004	MC013	MC017	MC021	MC032	MC035
Poaceae	*Brachyachne prostrata*												X																																																																						
Poaceae	*Cenchrus ciliaris*	*																			X	X		X	X	X						X								X					X																																									
Poaceae	*Cenchrus setiger*	*													X										X	X																																			X																										
Poaceae	*Chloris barbata*	*																																																																																			
Poaceae	*Chloris pectinata*																																																																																				
Poaceae	*Chloris pumilio*																								X																																																													
Poaceae	*Chrysopogon fallax*				X										X	X					X	X	X		X						X				X			X						X																																				X								X		
Poaceae	*Cymbopogon ambiguus*								X			X			X				X	X					X					X					X		X													X					X	X		X		X	X	X				X						X			X							X	X	X	X		X
Poaceae	*Cynodon dactylon*	*																																				X																																														
Poaceae	*Dactyloctenium radulans*															X		X				X											X				X	X																																																		
Poaceae	*Dichanthium sericeum* subsp. *humilius*				X	X								X		X															X	X		X	X	X																																																			
Poaceae	*Digitaria brownii*																																																																																				
Poaceae	*Digitaria ctenantha*																																																																																				
Poaceae	*Echinochloa colona*	*																																																																																			
Poaceae	*Enneapogon caerulescens*																						X	X					X			X				X																																													X	X											
Poaceae	*Enneapogon lindleyanus*								X						X		X																		X																					X				X				X				X									X	X	X											
Poaceae	*Enneapogon polyphyllus*															X						X	X																																																																		
Poaceae	*Enneapogon robustissimus*																																																																																				
Poaceae	*Enteropogon ramosus*																																																																																				
Poaceae	*Eragrostis crateriformis*		P3																												X																																																						
Poaceae	*Eragrostis cumingii*															X										X								X			X			X																									X														X												
Poaceae	*Eragrostis desertorum*																																																																																				
Poaceae	*Eragrostis eriopoda*																																							X																																					X			X									
Poaceae	*Eragrostis leptocarpa*																								X																																																													
Poaceae	*Eragrostis setifolia*																														X	X				X																																																			
Poaceae	*Eragrostis tenellula*																																X																																																						
Poaceae	*Eriachne avenacea*																																																																																				
Poaceae	*Eriachne benthamii*																		X																	X																																																	X		X
Poaceae	*Eriachne ciliata*																																															X											X			X	X	X		X																	X					
Poaceae	*Eriachne lanata*																																							X	X	X	X												X				X																												X	X	X	X	X		X
Poaceae	*Eriachne mucronata*							X											X						X																																X	X										X	X		X		X	X									X			X	X	X	X	X	X	X	X		X
Poaceae	*Eriachne obtusa*																																																						X																															
Poaceae	*Eriachne pulchella* subsp. *dominii*				X										X		X	X		X		X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	X	X	X								X										X			X		X	X						
Poaceae	*Eriochloa pseudoacrotricha*																																																																																				
Poaceae	*Eulalia aurea*																																																																																				
Poaceae	*Heteropogon contortus*																																																																																				
Poaceae	*Iseilema dolichotrichum*																	X	X	X			X	X		X						X				X	X																																																			
Poaceae	*Leptochloa fusca* subsp. *fusca*																																																																																				
Poaceae	*Panicum decompositum*																																																																																				
Poaceae	*Paraneurachne muelleri*						X												X		X	X			X		X			X						X			X																							X				X		X				X											X				X	X	
Poaceae	*Paspalidium clementii*												X				X	X							X																										X			X				X		X																														X		
Poaceae	*Paspalidium rarum*																					X	X														X																																																			
Poaceae	*Paspalidium tabulatum*																																																												X																							X		
Poaceae	*Perotis rara*															X						X	X																																																		X																
Poaceae	*Schizachyrium fragile*																		X																				X																			X																		X									
Poaceae	*Setaria surgens*																																																																																				
Poaceae	*Setaria verticillata*	*																																																																																	X		
Poaceae	*Sporobolus actinocladus*																																																																																				
Poaceae	*Sporobolus australasicus*				X			X						X	X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X		X					X										X															X	X		X					X	X										
Poaceae	*Themeda avenacea*																																																																																				
Poaceae	*Themeda triandra*							X							X					X			X		X	X			X	X							X																						X				X					X																					
Poaceae	*Tragus australianus*															X						X	X																																																																		
Poaceae	*Triodia angusta*																																											X	X	X																																							
Poaceae	*Triodia brizoides*																	X	X	X	X			X												X	X									X									X		X			X												X													
Poaceae	*Triodia epactia*															X					X			X		X	X	X	X	X			X		X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X	X
Poaceae	*Triodia longiceps*															X	X	X			X	X	X		X	X	X				X	X	X	X	X	X														X			X			X							X				X													X			X							
Poaceae	*Triodia wiseana*					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X					X	X	X		X	X	X	X	X	X						X	X	X			X	X		X					X	X	X	X	X														X		X	X	X	X	X									
Poaceae	*Tripogon loliiformis*																	X		X											X					X																																											X									
Poaceae	*Yakirra australiensis* var. *australiensis*				X					X								X						X		X																X														X																																		
Polygalaceae	*Polygala glaucifolia*																									X																																																													
Polygalaceae	*Polygala isingii*			X			X			X		X	X			X	X	X	X														X		X	X	X																	X					X				X	X	X																													
Portulacaceae	*Portulaca oleracea*																	X			X	X	X	X			X					X	X				X		X																																																	
Portulacaceae	*Portulaca pilosa*	*																														X																																																						
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*								X	X					X										X		X															X									X											X									X			X							X									
Proteaceae	*Grevillea wickhamii* agg.						X						X																					X							X	X	X		X	X		X					X	X	X	X	X		X	X	X	X	X	X		X	X	X							X		X		X						X	X	X	X	X	X	X
Proteaceae	*Hakea chordophylla*																						X			X								X				X	X		X	X	X	X																	X	X				X	X	X	X			X				X											
Proteaceae	*Hakea lorea subsp. lorea*									X					X			X										X																			X	X	X		X				X				X		X			X	X	X													X	X	X	X	X							
Pteridaceae	*Cheilanthes brownii*																									X																																																													
Rubiaceae	*Oldenlandia crouchiana*																		X						X										X	X																																																			
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*																																X																																																						
Santalaceae	*Santalum lanceolatum*																																																																	X										X						X		X
Sapindaceae	*Atalaya hemiglauca*																					X																																																																	
Sapindaceae	*Dodonaea coriacea*																										X																								X									X																					X						X
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*															X																																																					X																		
Scrophulariaceae	*Eremophila latrobei* subsp. *glabra*																		X																																																									X									
Scrophulariaceae	*Eremophila longifolia*																																				X																													X																				
Solanaceae	*Nicotiana occidentalis* subsp. *obliqua*																																																																																				
Solanaceae	*Nicotiana* sp.																																																																																				
Solanaceae	*Solanum diversiflorum*																									X																																				X																								
Solanaceae	*Solanum horridum*				X			X									X	X	X				X								X				X														X	X				X				X				X																								X		
Solanaceae	*Solanum phlomoides*																									X		X										X															X																		X															
Typhaceae	*Typha domingensis*																																																																																				
Urticaceae	*Parietaria cardiostegia*																																																																																			X
Violaceae	*Hybanthus aurantiacus*								X										X						X														X	X										X				X			X			X		X				X									X			X			X			X	X	X	X
Zygophyllaceae	*Tribulus hirsutus*																	X				X			X																																																				X									
Zygophyllaceae	*Tribulus occidentalis*																																																																																				
Zygophyllaceae	*Tribulus platypterus*																									X																																																													
Zygophyllaceae	*Tribulus suberosus*																			X	X	X											X						X																										X					X	X				X												X

Table 24: Flora inventory (site x species) for all quadrats in the survey area

Family	Species	MC038	MC040	MC104	MC119	MC042	MC098	MC107	MC111	MC145	MC151	MC20OP02	MCC-03	MCC-04	MCC-05	MCC-06	MCC-09	MCC-11	MCC-12	MCC-13	MCC-14	MCC-15	MCC-16	MCC-17	MCC-18	MCC-19	MCC-20	MCC-21	MCC-22	MCC-23	MCC-24	MCC-29	MCC-30	MCC-31	MCC-32	MCC-33	MCC-34	MCC-38	MC018	MC023	MC030	MC036	MC041	MC044	MC099	MC100	MC105	MC149	MC20OP06	MC20OP12	MC20Q07	MC142	MC143	MC20OP07	MC20OP13	MC20Q06	MC046	MC069	MC20Q24	MC002	MC011	MC015	MC016	MC022	MC024	MC029	MC037	MC086	MC088	MC124	MC128	MC047	MC063	MC064	MC068	MC074	MC091	MC093	MC125	MC144	MC20OP09	MC20OP14	MC20Q10	MC20Q11	MC20Q12	MC20Q27
	Vegetation type	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTe	ElAmTe	ElAmTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElGwTe	ElGwTe	ElGwTe	ElGwTe	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*																																																																											|X|													
Acanthaceae	*Rostellularia adscendens* var. *latifolia*																												|X|																																																									
Aizoaceae	*Trianthema triquetra*																	X																X				X																																																	
Aizoaceae	*Trianthema triquetrum*																																																																																						
Aizoaceae	*Zaleya galericulata* subsp. *galericulata*																																																																																								
Amaranthaceae	*Achyranthes aspera*											X						X		X	X	X	X				X			X					X	X																																																					
Amaranthaceae	*Aerva javanica*								X			X			X			X		X						X	X		X	X				X	X			X														X			X																	X				X			X	X				X		
Amaranthaceae	*Alternanthera angustifolia*																							X	X						X																																																								
Amaranthaceae	*Alternanthera nana*					X		X	X							X	X	X	X	X												X	X	X	X		X	X																																						X	X		X				X		X	
Amaranthaceae	*Alternanthera nodiflora*																																																																																						
Amaranthaceae	*Amaranthus cuspidifolius*												X	X								X	X	X	X			X		X																																																								
Amaranthaceae	*Amaranthus undulatus*			X				X	X		X		X			X	X	X	X	X	X	X			X		X			X		X	X	X	X	X	X	X		X												X																				X	X	X	X	X		X	X	X		X				
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*																X																	X																																												X								
Amaranthaceae	*Gomphrena cunninghamii*	X		X		X																																		X												X			X																	X	X				X		X	X						
Amaranthaceae	*Ptilotus aervoides*																																																																																							
Amaranthaceae	*Ptilotus astrolasius*						X		X	X																														X																																X				X		X								
Amaranthaceae	*Ptilotus auriculifolius*																																																																										X				X						
Amaranthaceae	*Ptilotus axillaris*							X																																																																					X	X									
Amaranthaceae	*Ptilotus calostachyus*	X	X	X	X		X																																	X	X	X	X	X	X	X			X	X	X	X							X						X			X		X	X	X	X	X	X				X									
Amaranthaceae	*Ptilotus clementii*																																										X																																			X							
Amaranthaceae	*Ptilotus exaltatus*											X																																							X		X																			X	X					X								
Amaranthaceae	*Ptilotus fusiformis*					X	X																																													X																									X		X								
Amaranthaceae	*Ptilotus helipteroides*																																																																																						
Amaranthaceae	*Ptilotus incanus*			X							X																													X				X											X																		X	X	X											
Amaranthaceae	*Ptilotus mollis*																																												X																																								
Amaranthaceae	*Ptilotus obovatus*																																																		X		X		X																					X	X		X							
Apocynaceae	*Calotropis procera*																																																																																						
Apocynaceae	*Carissa lanceolata*	X				X	X			X	X																					X			X									X																																			X			X				
Apocynaceae	*Marsdenia angustata*																																											X																																									
Araliaceae	*Trachymene oleracea* subsp. *oleracea*																																																																																							
Asteraceae	*Calocephalus beardii*																																																																																							
Asteraceae	*Calocephalus knappii*																																																																																						
Asteraceae	*Centipeda minima* subsp. *macrocephala*																X	X	X		X	X			X						X	X	X	X	X	X		X																																																
Asteraceae	*Flaveria trinervia*																																																																													X								
Asteraceae	*Minuria integerrima*																																																																																							
Asteraceae	*Pentalepis trichodesmoides* subsp. *trichodesmoides*																																																																																							
Asteraceae	*Peripleura virgata*																																													X													X														X												
Asteraceae	*Pluchea dentex*						X																																																																							X	X					X		X	
Asteraceae	*Pluchea ferdinandi-muelleri*																	X																																			X																	X			X		X	X		X			X					
Asteraceae	*Pluchea rubelliflora*												X									X			X		X				X																																																X		X							
Asteraceae	*Pluchea tetranthera*						X								X	X	X	X	X	X	X											X	X	X	X	X	X	X					X	X								X	X	X	X		X															X		X	X	X	X			X	X	X		X				
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*																																																																										X											X		
Asteraceae	*Pterocaulon sphacelatum*												X					X		X		X			X							X					X																																													X	X			
Asteraceae	*Pterocaulon sphaeranthoides*					X		X	X																																											X																				X			X		X		X	X						
Asteraceae	*Sonchus oleraceus*												X	X				X			X				X							X	X																																																						
Asteraceae	*Streptoglossa bubakii*																																																																																							
Asteraceae	*Streptoglossa liatroides*																																																																																							
Asteraceae	*Streptoglossa* sp.																																																																																							
Boraginaceae	*Ehretia saligna var. saligna*					X	X			X	X																																			X																																								
Boraginaceae	*Heliotropium chrysocarpum*																																											X																																									
Boraginaceae	*Heliotropium crispatum*																																																																																							
Boraginaceae	*Heliotropium cunninghamii*											X																						X																																															X									
Boraginaceae	*Heliotropium heteranthum*																																																																																							
Boraginaceae	*Heliotropium inexplicitum*																																							X																																														
Boraginaceae	*Heliotropium pachyphyllum*																																																																													X	X								
Boraginaceae	*Heliotropium skeleton*																																																																			X																		
Boraginaceae	*Heliotropium* sp.																																																																																							
Boraginaceae	*Heliotropium tenuifolium*						X			X																																			X																							X																			
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*					X	X			X	X																																	X					X																									X	X	X		X			X	X						
Campanulaceae	*Wahlenbergia tumidifructa*																																																																																								
Capparaceae	*Capparis spinosa* var. *nummularia*																																			X	X																																																	
Caryophyllaceae	*Polycarpaea corymbosa*							X	X								X																													X																															X	X		X	X						
Caryophyllaceae	*Polycarpaea holtzei*	X						X	X																															X	X	X	X	X	X	X			X			X	X		X						X	X			X	X			X	X	X				X	X		X			X	X						
Caryophyllaceae	*Polycarpaea longiflora*					X			X																																												X		X																	X				X				X						
Celastraceae	*Stackhousia intermedia*																																																											X								X	X																		
Celastraceae	*Stackhousia muricata*																																																																																							
Chenopodiaceae	*Dysphania plantaginella*																																																																																							
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*	X				X		X	X							X	X																	X																															X											X	X			X						
Chenopodiaceae	*Dysphania sphaerosperma*																																																																																							
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*																																																																																								
Chenopodiaceae	*Maireana sp.*																																																																																							
Chenopodiaceae	*Rhagodia eremaea*																																																																										X					X							
Chenopodiaceae	*Salsola australis*																																																																									X		X											X		
Chenopodiaceae	*Sclerolaena cornishiana*																																																																																							
Chenopodiaceae	*Sclerolaena costata*																																																																																							
Cleomaceae	*Cleome viscosa*					X	X	X	X			X					X		X		X	X	X	X	X		X	X		X	X	X		X		X	X																X			X																						X	X		X	X			X	X		X	
Convolvulaceae	*Bonamia erecta*						X																																																																								X								
Convolvulaceae	*Bonamia pilbarensis*											X																																										X																																	
Convolvulaceae	*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)	X	X	X	X																																			X	X	X	X	X	X	X			X												X	X		X	X			X	X	X	X	X	X	X		X													
Convolvulaceae	*Duperreya commixta*					X																														X																			X		X																																
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*	X				X	X	X	X		X	X																																																																			X	X	X	X				X	X	
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*						X	X	X	X			X	X	X		X	X	X	X			X		X	X						X	X		X											X			X		X	X			X	X																		X	X			X	X	X	X	X	X	X		X	
Convolvulaceae	*Ipomoea muelleri*																	X	X						X						X	X	X		X	X			X																																																	
Convolvulaceae	*Ipomoea* sp.																																																	X																																					
Convolvulaceae	*Operculina aequisepala*																																X					X																																																		
Convolvulaceae	*Polymeria ambigua*	X				X	X	X	X	X		X					X						X							X		X			X			X																																							X	X	X	X	X	X	X	X	X	X	
Cucurbitaceae	*Austrobryonia pilbarensis*																																																																																							
Cucurbitaceae	*Citrullus amarus*																						|X|																																																															
Cucurbitaceae	*Cucumis melo*																																																																																							
Cucurbitaceae	*Cucumis variabilis*	X				X				X		X										X	X		X					X																									X	X																	X	X		X				X	X				X	
Cyperaceae	*Bulbostylis barbata*					X	X																																	X	X	X	X		X	X	X			X			X	X		X											X				X	X			X							X	X						
Cyperaceae	*Bulbostylis turbinata*																																																																																							
Cyperaceae	*Cyperus bifax*																																																																																				X			X
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*																																																																														X								

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTe	ElAmTe	ElAmTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElGwTe	ElGwTe	ElGwTe	ElGwTe	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci
Family	Species	MC038	MC040	MC104	MC119	MC042	MC098	MC107	MC111	MC145	MC151	MC20OP02	MCC-03	MCC-04	MCC-05	MCC-06	MCC-09	MCC-11	MCC-12	MCC-13	MCC-14	MCC-15	MCC-16	MCC-17	MCC-18	MCC-19	MCC-20	MCC-21	MCC-22	MCC-23	MCC-24	MCC-29	MCC-30	MCC-31	MCC-32	MCC-33	MCC-34	MCC-38	MC018	MC023	MC030	MC036	MC041	MC044	MC099	MC100	MC105	MC149	MC20OP06	MC20OP12	MC20Q07	MC142	MC143	MC20OP07	MC20OP13	MC20Q06	MC046	MC069	MC20Q24	MC002	MC011	MC015	MC016	MC022	MC024	MC029	MC037	MC086	MC088	MC124	MC128	MC047	MC063	MC064	MC068	MC074	MC091	MC093	MC125	MC144	MC20OP09	MC20OP14	MC20Q10	MC20Q11	MC20Q12	MC20Q27
Cyperaceae	*Cyperus difformis*																				X			X						X																																																							
Cyperaceae	*Cyperus iria*																				X			X			X		X																																																							
Cyperaceae	*Cyperus ixiocarpus*																																																																												X							X	
Cyperaceae	*Cyperus squarrosus*																																																																																						
Cyperaceae	*Cyperus vaginatus*											X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X																																							X	X									
Cyperaceae	*Fimbristylis dichotoma*																																						X						X	X					X	X	X	X	X				X		X		X	X		X	X	X	X	X															
Cyperaceae	*Fimbristylis microcarya*																																				X																																														X	
Cyperaceae	*Fimbristylis simulans*	X	X	X																																				X			X				X												X	X			X		X		X	X		X															
Cyperaceae	*Schoenoplectiella laevis*																							X					X																																																								
Cyperaceae	*Schoenoplectus subulatus*														X		X		X																																																																		
Elatinaceae	*Bergia pedicellaris*																																																																																						
Euphorbiaceae	*Adriana tomentosa var. tomentosa*																								X																																																												
Euphorbiaceae	*Euphorbia alsiniflora*														X	X	X	X	X	X											X	X	X	X	X	X	X																																																
Euphorbiaceae	*Euphorbia australis*					X		X	X	X			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X			X																																						X	X	X	X	X			X			
Euphorbiaceae	*Euphorbia biconvexa*													X								X	X	X	X	X	X	X	X	X																																																			X	X			
Euphorbiaceae	*Euphorbia boophthona*																																						X	X																																			X										
Euphorbiaceae	*Euphorbia careyi*																																																																																						
Euphorbiaceae	*Euphorbia hirta*																													X																																																						
Euphorbiaceae	*Euphorbia schultzii*						X																																X																																		X													
Euphorbiaceae	*Euphorbia* sp.																																																																																			X	X
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*																																																																											X									
Euphorbiaceae	*Euphorbia trigonosperma*					X		X	X	X	X																																																																	X	X	X	X	X						
Fabaceae	*Acacia acradenia*					X	X	X	X	X	X	X															X																X			X	X																									X				X				X	X		X	X		X
Fabaceae	*Acacia adoxa var. adoxa*																																																																																						
Fabaceae	*Acacia adsurgens*																																																																																			X	X
Fabaceae	*Acacia ampliceps*																X	X			X	X	X		X		X	X	X	X	X							X																																																		
Fabaceae	*Acacia ancistrocarpa*																																																																											X									
Fabaceae	*Acacia aphanoclada*																																																																																						
Fabaceae	*Acacia aphanoclada x pyrifolia* var. *pyrifolia*																																																		X																																			
Fabaceae	*Acacia bivenosa*				X	X	X	X	X	X	X	X	X	X			X		X													X	X					X	X	X	X	X	X	X		X		X		X	X	X	X							X	X				X			X		X	X	X	X	X		X	X	X	X	X			X	X		
Fabaceae	*Acacia colei* var. *colei*																																																																																		X		
Fabaceae	*Acacia coriacea* subsp. *pendens*																							X	X		X	X	X	X	X			X	X	X	X	X													X			X																						X	X					X			X
Fabaceae	*Acacia eriopoda*																																							X																				X				X	X	X					X							X								
Fabaceae	*Acacia holosericea*																																																																																						
Fabaceae	*Acacia inaequilatera*	X																																					X	X	X	X	X	X	X	X	X		X	X			X		X					X	X			X		X				X	X			X							X				X	
Fabaceae	*Acacia maitlandii*																										X																																																										
Fabaceae	*Acacia monticola*		X	X	X							X																												X												X		X	X	X	X	X	X				X									X			X											X
Fabaceae	*Acacia orthocarpa*	X										X																																																			X						X									X									
Fabaceae	*Acacia pruinocarpa*			X																																					X																																	X												
Fabaceae	*Acacia ptychophylla*	X	X		X					X																														X	X		X	X				X			X				X					X	X	X	X	X	X	X	X	X	X		X								X							
Fabaceae	*Acacia pyrifolia* agg.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X					X						X															X	X	X	X					X	X	X	X	X		X	X	X	X	X
Fabaceae	*Acacia retivenea* subsp. *clandestina*																																							X																						X				X	X																			
Fabaceae	*Acacia* sp.																																																																																						
Fabaceae	*Acacia synchronicia*																																									X	X			X						X	X																				X						X			X				
Fabaceae	*Acacia tenuissima*																																																											X																									
Fabaceae	*Acacia trachycarpa*		X						X				X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X			X																																						X	X	X	X	X		X		X	X	
Fabaceae	*Acacia trachycarpa x tumida* var. *pilbarensis*																																																																																						
Fabaceae	*Acacia tumida* var. *pilbarensis*	X	X	X		X	X		X	X	X	X		X			X								X													X				X																																X	X	X	X			X	X	X	X	
Fabaceae	*Aeschynomene indica*																																																																																						
Fabaceae	*Alysicarpus muelleri*																X	X	X	X														X																																											X			X						
Fabaceae	*Crotalaria medicaginea* var. *neglecta*	X					X	X	X	X						X													X			X																																											X	X	X	X	X			X			
Fabaceae	*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*																																																																																						
Fabaceae	*Crotalaria* sp.																																																																																						
Fabaceae	*Cullen graveolens*																																																																																						
Fabaceae	*Cullen leucanthum*												X										X	X	X		X	X	X	X	X																																																							
Fabaceae	*Cullen leucochaites*																										X																																																							X						
Fabaceae	*Desmodium muelleri*																																																																																						
Fabaceae	*Gastrolobium grandiflorum*										X																																																				X																						
Fabaceae	*Glycine canescens*					X							X		X	X	X					X				X	X				X					X																																													X						
Fabaceae	*Gompholobium oreophilum*	X	X		X																																																									X																			
Fabaceae	*Indigastrum parviflorum*																																																																																						
Fabaceae	*Indigofera colutea*									X					X	X							X																																																				X			X	X						
Fabaceae	*Indigofera linifolia*							X								X			X														X																																													X		X		X				
Fabaceae	*Indigofera linnaei*							X																																																																										X			
Fabaceae	*Indigofera monophylla*	X	X		X	X	X	X	X	X	X						X		X						X	X			X		X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X				X	X	X		X	X	X	X		X	X	X						X	X	X	X		X	X	X	X	
Fabaceae	*Indigofera rugosa*								X																																																																						X	X					
Fabaceae	*Indigofera* sp.																																																																																				X	
Fabaceae	*Indigofera trita* subsp. *trita*														X		X														X		X																			X																																			
Fabaceae	*Isotropis atropurpurea*	X	X				X	X		X																																	X				X					X		X																X							X			X					
Fabaceae	*Neptunia dimorphantha*																																																																																						
Fabaceae	*Petalostylis labicheoides*					X					X											X	X	X	X	X	X	X	X	X				X			X					X																																	X			X					X		
Fabaceae	*Rhynchosia minima*						X		X	X	X	X			X	X	X	X	X				X		X	X	X		X			X	X	X		X	X																		X																		X			X	X	X	X	X		X		X	X	
Fabaceae	*Senna artemisioides* subsp. *helmsii*																																										X																												X															
Fabaceae	*Senna artemisioides* subsp. *oligophylla*					X			X		X																																																																								X				
Fabaceae	*Senna artemisioides* subsp. *oligophylla x helmsii*																																																																																X					
Fabaceae	*Senna glutinosa* subsp. *glutinosa*	X		X	X	X	X	X		X	X	X																									X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X		X	X		X	X		X	X	X	X	X	X	X	X			X				X		
Fabaceae	*Senna glutinosa* subsp. *glutinosa x luerssenii*						X																																																																							X							
Fabaceae	*Senna glutinosa* subsp. *pruinosa*																																								X		X		X					X	X	X	X		X					X							X			X		X		X						X						
Fabaceae	*Senna notabilis*	X					X	X		X						X					X		X	X																																																							X				X				
Fabaceae	*Senna symonii*				X		X			X																												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X						X	X	X	X			X	X			X			X			X						
Fabaceae	*Senna venusta*						X																																																																														
Fabaceae	*Sesbania cannabina*															X	X	X	X	X	X	X		X	X		X	X	X	X		X	X	X	X	X	X	X																																								X						X	X	
Fabaceae	*Swainsona decurrens*																																																																															X						
Fabaceae	*Swainsona formosa*																																																																											X										
Fabaceae	*Swainsona stenodonta*																																																																															X						
Fabaceae	*Tephrosia clementii*																																																																																				X	
Fabaceae	*Tephrosia densa*																																																																																						
Fabaceae	*Tephrosia rosea* var. *clementii*						X	X	X								X			X																																																									X	X	X	X		X	X		X	X	X
Fabaceae	*Tephrosia* sp.																																																																																						
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 1161)	X						X																																																																													
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 356)																																						X	X	X	X	X	X	X		X	X	X			X	X	X	X										X		X				X						X									X
Fabaceae	*Tephrosia virens*		X																																																																															X				
Fabaceae	*Vachellia farnesiana*																X														X		X	X			X																																															
Fabaceae	*Vigna lanceolata* var. *lanceolata*												X	X	X			X	X			X		X	X					X	X	X	X	X	X		X	X																																															

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTe	ElAmTe	ElAmTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElGwTe	ElGwTe	ElGwTe	ElGwTe	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci
Family	**Species**	MC038	MC040	MC104	MC119	MC042	MC098	MC107	MC111	MC145	MC151	MC20OP02	MCC-03	MCC-04	MCC-05	MCC-06	MCC-09	MCC-11	MCC-12	MCC-13	MCC-14	MCC-15	MCC-16	MCC-17	MCC-18	MCC-19	MCC-20	MCC-21	MCC-22	MCC-23	MCC-24	MCC-29	MCC-30	MCC-31	MCC-32	MCC-33	MCC-34	MCC-38	MC018	MC023	MC030	MC036	MC041	MC044	MC099	MC100	MC105	MC149	MC20OP06	MC20OP12	MC20Q07	MC142	MC143	MC20OP07	MC20OP13	MC20Q06	MC046	MC069	MC20Q24	MC002	MC011	MC015	MC016	MC022	MC024	MC029	MC037	MC086	MC088	MC124	MC128	MC047	MC063	MC064	MC068	MC074	MC091	MC093	MC125	MC144	MC20OP09	MC20OP14	MC20Q10	MC20Q11	MC20Q12	MC20Q27
Goodeniaceae	*Dampiera candicans*	X	X	X	X	X	X			X		X																												X	X	X	X		X	X					X				X	X					X	X	X	X	X	X	X	X	X		X		X				X	X			X			X		
Goodeniaceae	*Goodenia cusackiana*											X																																	X			X			X	X			X																		X															
Goodeniaceae	*Goodenia lamprosperma*																																																																																				
Goodeniaceae	*Goodenia microptera*						X																							X										X																																							X	X							X	
Goodeniaceae	*Goodenia muelleriana*	X				X		X	X																																																																					X		X	X				X		
Goodeniaceae	*Goodenia nuda*																																																																																			
Goodeniaceae	*Goodenia stobbsiana*	X	X	X			X		X			X																											X	X	X			X	X		X		X	X							X	X	X	X		X	X	X	X	X	X	X	X		X		X	X	X			X		X				X		
Goodeniaceae	*Goodenia triodiophila*	X																																						X	X	X	X	X	X		X	X	X		X	X	X		X	X				X	X	X	X	X	X		X	X	X		X															
Goodeniaceae	*Scaevola amblyanthera* var. *centralis*							X	X			X																																																																			X	X					X
Goodeniaceae	*Scaevola browniana* subsp. *browniana*						X																																																																							X								
Goodeniaceae	*Scaevola spinescens*					X					X	X																																										X																																X
Haloragaceae	*Haloragis gossei*	X																																																																																		
Lamiaceae	*Clerodendrum floribundum*																																																				X	X																												X		
Lamiaceae	*Clerodendrum tomentosum* var. *lanceolatum*				X																																			X									X																											X	X											
Lauraceae	*Cassytha capillaris*																																											X											X																							X								
Loranthaceae	*Amyema preissii*																																																																																			
Loranthaceae	*Amyema sanguinea* var. *sanguinea*																															X			X																																												X								
Lythraceae	*Ammannia baccifera*																								X		X	X	X		X																																																					
Lythraceae	*Ammannia multiflora*																	X	X	X	X											X	X			X	X	X																																														
Malvaceae	*Abutilon fraseri*																																																																																			
Malvaceae	*Abutilon lepidum*										X																								X	X																																								X			X	X						
Malvaceae	*Abutilon macrum*					X					X					X			X	X																X																																											X							
Malvaceae	*Abutilon malvifolium*																																																																																			
Malvaceae	*Abutilon oxycarpum* subsp. Prostrate (A.A. Mitchell PRP 1266)																																																																																			
Malvaceae	*Abutilon* sp.																	X																		X																																																
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)																																																																																			
Malvaceae	*Androcalva luteiflora*																																																																												X							X			
Malvaceae	*Corchorus crozophorifolius*											X																																																																							X		X
Malvaceae	*Corchorus lasiocarpus* subsp. *lasiocarpus*											X			X		X	X	X				X			X	X				X			X																																						X	X		X	X			X	X		X				
Malvaceae	*Corchorus parviflorus*	X	X		X	X	X	X	X	X	X	X								X												X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X				X		X					X								X	X	X	X	X	X	X			X	X	X
Malvaceae	*Corchorus* sp.																																																																																			
Malvaceae	*Corchorus tridens*																																	X	X		X																																										X							
Malvaceae	*Gossypium australe*						X	X	X	X		X			X		X					X	X			X			X			X	X		X	X		X							X		X		X				X		X														X					X	X	X	X	X	X	X		X	X	X	X	X
Malvaceae	*Gossypium robinsonii*					X	X			X	X																																	X																																	X			X	X		X	X		X	
Malvaceae	*Hibiscus austrinus* var. *austrinus*																																																																																			
Malvaceae	*Hibiscus coatesii*	X			X							X																												X	X	X		X			X	X				X	X	X	X	X							X								X		X	X	X											
Malvaceae	*Hibiscus goldsworthii*																																																																								X	X	X											
Malvaceae	*Hibiscus leptocladus*																																																																													X								
Malvaceae	*Hibiscus* sp.												X	X	X							X			X	X	X			X																																																				X				
Malvaceae	*Hibiscus sturtii* agg.	X	X	X		X	X	X	X	X	X																													X	X	X	X					X													X	X					X		X		X			X			X		X							
Malvaceae	*Malvastrum americanum*					X		X	X							X	X	X	X													X	X	X	X	X	X	X																																							X			X	X						
Malvaceae	*Melhania oblongifolia*							X	X	X	X	X					X	X														X	X	X		X																		X																							X		X	X	X		X	X		X	
Malvaceae	*Seringia nephrosperma*	X																																																																																		
Malvaceae	*Seringia* sp.	X																																																																																		
Malvaceae	*Sida ?arenicola*	X																																																																																		
Malvaceae	*Sida ?macropoda* (complex)			X																																																																			X	X	X	X											
Malvaceae	*Sida aff. fibulifera*																																																																																		
Malvaceae	*Sida clementii*					X																																																																										X	X						
Malvaceae	*Sida echinocarpa*							X	X			X																														X						X				X																											X	X	X		X	X			X	
Malvaceae	*Sida fibulifera*							X	X		X		X	X	X		X	X					X									X	X		X			X											X																																X	X		X		
Malvaceae	*Sida macropoda*																																																																																		
Malvaceae	*Sida rohlenae* subsp. *rohlenae*	X				X	X			X	X		X	X	X							X	X	X					X	X													X				X					X												X							X	X	X	X		X			X		X				
Malvaceae	*Sida* sp. Articulation below (A.A. Mitchell PRP 165)	X	X	X	X					X																																X												X		X					X	X	X			X			X																	
Malvaceae	*Sida* sp. Excedentifolia (J.L. Egan 1925)	X																																						X	X		X											X		X				X					X		X	X					X	X												
Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)		X				X	X		X		X																												X		X	X		X		X	X		X								X	X					X						X	X	X	X	X	X		X									
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/9)					X																																													X	X																					X					X							
Malvaceae	*Sida* sp. verrucose glands (F.H. Mollemans 2423)								X	X																																									X																											X	X						
Malvaceae	*Triumfetta chaetocarpa*					|X|																																																																							|X|							
Malvaceae	*Triumfetta clementii*					X											X			X				X			X	X						X																																									X		X	X			X	X			X			
Malvaceae	*Triumfetta maconochieana*	X					X				X																													X							X												X																												
Malvaceae	*Triumfetta propinqua*																																																																																		
Malvaceae	*Waltheria indica*																						X																																																								X								
Malvaceae	*Waltheria virgata*				X		X			X		X																														X		X										X												X			X																
Marsileaceae	*Marsilea hirsuta*																X	X	X			X			X							X	X		X		X	X																																							X									
Menispermaceae	*Tinospora smilacina*																																			X																																																
Molluginaceae	*Trigastrotheca molluginea*	X				X	X	X	X	X		X																												X		X	X		X	X	X			X			X														X	X			X	X		X			X	X		X					X	
Moraceae	*Ficus brachypoda*			X																																																																															
Myrtaceae	*Corymbia candida* subsp. *dipsodes*																																																																																	X	
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*																																																												X				X																		
Myrtaceae	*Corymbia ferriticola*										X																																													X		X	X				X															X			
Myrtaceae	*Corymbia hamersleyana*	X	X	X	X	X	X	X	X			X						X									X								X									X											X					X	X	X		X	X	X		X	X	X	X						X			X	X	X		X		
Myrtaceae	*Eucalyptus camaldulensis*												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																																																
Myrtaceae	*Eucalyptus leucophloia* subsp. *leucophloia*	X			X	X				X	X																												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
Myrtaceae	*Eucalyptus victrix*						X		X				X	X	X	X	X	X	X	X				X	X	X		X	X	X	X	X	X	X	X	X	X	X																																							X	X	X	X	X		X	X	X	X	X
Myrtaceae	*Melaleuca bracteata*												X	X	X	X								X	X							X						X																																						X										
Myrtaceae	*Melaleuca glomerata*															X	X	X		X	X	X	X	X	X		X	X	X	X	X		X	X				X																																								X							X	X
Nyctaginaceae	*Boerhavia burbidgeana*																																																																															X			
Nyctaginaceae	*Boerhavia coccinea*						X																						X																																																X	X		X	X				X		X
Nyctaginaceae	*Boerhavia gardneri*											X		X		X	X	X			X										X			X				X																	X																														X	
Nyctaginaceae	*Boerhavia repleta*																					X	X	X	X	X	X	X	X	X																																																		X				
Nyctaginaceae	*Boerhavia schomburgkiana*															X	X	X		X	X											X	X	X	X	X	X	X																																								X							
Oleaceae	*Jasminum didymum* subsp. *lineare*	X				X			X	X	X																																						X																								X		X			X	X						
Papavaceae	*Argemone ochroleuca*														X					X	X		X	X							X	X	X	X	X	X	X																																																
Phyllanthaceae	*Notoleptopus decaisnei*					X	X				X										X											X																																														X			X	X						
Phyllanthaceae	*Phyllanthus erwinii*																																																																																			
Phyllanthaceae	*Phyllanthus maderaspatensis*					X	X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X																																									X	X	X	X	X	X	X	X			X
Plantaginaceae	*Stemodia grossa*											X				X	X	X	X	X	X	X			X		X	X	X		X	X	X		X	X	X	X																																									X	X						X	X	
Poaceae	*Amphipogon sericeus*	X	X																																							X	X		X																							X																				
Poaceae	*Aristida contorta*					X				X	X																													X						X																			X							X	X	X	X	X	X	X	X	X						
Poaceae	*Aristida holathera* var. *holathera*	X					X																																																											X																	X	
Poaceae	*Aristida hygrometrica*																																																																																			
Poaceae	*Aristida latifolia*																																																																																			
Poaceae	*Bothriochloa ewartiana*							X	X										X																																																																	
Poaceae	*Brachyachne convergens*																																																																														X						

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	ChAmTe	ChAmTe	ChAmTe	ChAmTe	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	ChApyTt	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	EcApyCci	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAbTe	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTb	ElAmTe	ElAmTe	ElAmTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElAptTe	ElGwTe	ElGwTe	ElGwTe	ElGwTe	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci
Family	Species	MC038	MC040	MC104	MC119	MC042	MC098	MC107	MC111	MC145	MC151	MC20OP02	MCC-03	MCC-04	MCC-05	MCC-06	MCC-09	MCC-11	MCC-12	MCC-13	MCC-14	MCC-15	MCC-16	MCC-17	MCC-18	MCC-19	MCC-20	MCC-21	MCC-22	MCC-23	MCC-24	MCC-29	MCC-30	MCC-31	MCC-32	MCC-33	MCC-34	MCC-38	MC018	MC023	MC030	MC036	MC041	MC044	MC099	MC100	MC105	MC149	MC20OP06	MC20OP12	MC20Q07	MC142	MC143	MC20OP07	MC20OP13	MC20Q06	MC046	MC069	MC20Q24	MC002	MC011	MC015	MC016	MC022	MC024	MC029	MC037	MC086	MC088	MC124	MC128	MC047	MC063	MC064	MC068	MC074	MC091	MC093	MC125	MC144	MC20OP09	MC20OP14	MC20Q10	MC20Q11	MC20Q12	MC20Q27
Poaceae	*Brachyachne prostrata*																																												X																																										
Poaceae	*Cenchrus ciliaris*										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		X																				X	X	X	X	X	X	X	X	X	X	X
Poaceae	*Cenchrus setiger*																																																																																	X	X	
Poaceae	*Chloris barbata*																			X																																																																	
Poaceae	*Chloris pectinata*																													X																																																							
Poaceae	*Chloris pumilio*																															X																																																					
Poaceae	*Chrysopogon fallax*					X	X	X	X	X			X		X		X															X	X		X																		X																				X	X	X	X		X	X	X	X	
Poaceae	*Cymbopogon ambiguus*			X		X	X			X	X	X						X					X			X				X		X								X	X		X	X	X	X	X	X	X	X	X		X	X	X	X		X				X	X					X					X	X	X	X	X	X	X	X	X	X	X		X		X
Poaceae	*Cynodon dactylon*															X	X													X																																																		X			
Poaceae	*Dactyloctenium radulans*															X	X	X		X	X											X	X					X																																												X				
Poaceae	*Dichanthium sericeum* subsp. *humilius*																		X																																																																			X			
Poaceae	*Digitaria brownii*					X																																																																									X								
Poaceae	*Digitaria ctenantha*																																																																														X								
Poaceae	*Echinochloa colona*												X	X		X	X	X	X	X	X	X		X	X		X			X	X	X	X	X	X	X	X																																															X			
Poaceae	*Enneapogon caerulescens*																																																																																						
Poaceae	*Enneapogon lindleyanus*					X	X		X	X	X	X								X	X																X																			X	X	X																		X	X		X	X		X	X				X		
Poaceae	*Enneapogon polyphyllus*																																														X										X																										X	X						
Poaceae	*Enneapogon robustissimus*														X										X																																																										X				
Poaceae	*Enteropogon ramosus*																		X				X				X				X																																																							
Poaceae	*Eragrostis crateriformis*																																																																																						
Poaceae	*Eragrostis cumingii*					X	X	X	X		X							X	X													X	X	X	X	X																																												X		X			X		X	
Poaceae	*Eragrostis desertorum*																																																																																						
Poaceae	*Eragrostis eriopoda*																																																																													X		X					X	
Poaceae	*Eragrostis leptocarpa*																																																																																						
Poaceae	*Eragrostis setifolia*																																																																																						
Poaceae	*Eragrostis tenellula*																X	X	X		X												X	X	X	X	X		X																																										X									
Poaceae	*Eriachne avenacea*																																																								X																																
Poaceae	*Eriachne benthamii*						X									X	X	X	X	X						X		X		X	X	X		X	X																																													X	X	X	X						X	
Poaceae	*Eriachne ciliata*																																								X														X							X	X	X	X	X	X	X	X	X	X	X	X														
Poaceae	*Eriachne lanata*	X			X																																					X	X			X		X													X	X	X			X											X													
Poaceae	*Eriachne mucronata*			X	X	X	X			X	X																															X	X	X	X	X			X	X	X	X	X	X	X	X	X	X				X			X	X	X		X				X	X	X	X	X						X		X	X	X	X
Poaceae	*Eriachne obtusa*																			X																												X																																X	X								
Poaceae	*Eriachne pulchella* subsp. *dominii*																																																	X		X																																					
Poaceae	*Eriochloa pseudoacrotricha*																													X																																																									
Poaceae	*Eulalia aurea*																																																																																			X	
Poaceae	*Heteropogon contortus*																																																																																			X	
Poaceae	*Iseilema dolichotrichum*																																																																									X														
Poaceae	*Leptochloa fusca* subsp. *fusca*												X	X		X	X	X		X	X	X			X		X																																																													
Poaceae	*Panicum decompositum*																		X																																																													X								
Poaceae	*Paraneurachne muelleri*	X				X	X		X	X		X																																												X																								X		X	X		X	X	X	X	
Poaceae	*Paspalidium clementii*									X	X																																										X															X									X			X								
Poaceae	*Paspalidium rarum*																																																																																						
Poaceae	*Paspalidium tabulatum*																																																																																						
Poaceae	*Perotis rara*					X			X																																																																				X								
Poaceae	*Schizachyrium fragile*																																								X																				X		X						X	X	X														X		X	
Poaceae	*Setaria surgens*																																																																													X									
Poaceae	*Setaria verticillata*								X																																																																					X								
Poaceae	*Sporobolus actinocladus*																																																																																						
Poaceae	*Sporobolus australasicus*	X				X	X						X			X				X	X				X						X																																												X		X	X			X		X	X			X	X		
Poaceae	*Themeda avenacea*																																																																																						
Poaceae	*Themeda triandra*					X	X	X	X	X		X					X	X														X	X	X																							X		X																					X	X	X	X	X	X	X	X	X	X
Poaceae	*Tragus australianus*																																																																																						
Poaceae	*Triodia angusta*																																																																																						
Poaceae	*Triodia brizoides*																																							X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X					X	X	X	X	X		X			X	X																
Poaceae	*Triodia epactia*	X	X	X	X	X	X		X	X	X	X																											X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X			X		
Poaceae	*Triodia longiceps*					X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X					X					X				X																								X	X	X	X	X	X		X	X	X	X	
Poaceae	*Triodia wiseana*								X				X		X							X	X		X	X			X																X	X				X				X	X																											X			X	X		X				
Poaceae	*Tripogon loliiformis*																																														X						X	X																																			
Poaceae	*Yakirra australiensis* var. *australiensis*																																																																X																							
Polygalaceae	*Polygala glaucifolia*																																																																																						
Polygalaceae	*Polygala isingii*	X																																							X	X				X	X	X				X	X							X		X		X	X	X		X	X	X	X																
Portulacaceae	*Portulaca oleracea*																X		X			X	X							X				X	X	X																																														X					X	X			
Portulacaceae	*Portulaca pilosa*																																																																																						
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*							X															X		X	X																																														X							X						
Proteaceae	*Grevillea wickhamii* agg.	X	X	X	X	X	X		X	X	X	X																												X	X			X		X		X		X							X	X	X	X	X	X	X	X			X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X		
Proteaceae	*Hakea chordophylla*	X			X																																								X																X					X	X		X																	X			
Proteaceae	*Hakea lorea subsp. lorea*						X	X																															X									X		X		X	X		X	X			X			X									X							X									
Pteridaceae	*Cheilanthes brownii*																																																								X	X	X																													
Rubiaceae	*Oldenlandia crouchiana*																																												X																																										
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*																																																																																						
Santalaceae	*Santalum lanceolatum*					X				X	X																																																																													X
Sapindaceae	*Atalaya hemiglauca*						X						X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X														X			X																							X			X	X		X	X		X	X
Sapindaceae	*Dodonaea coriacea*				X																																			X	X	X				X		X													X	X	X	X	X	X	X			X	X																
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*																																																	X						X																																		
Scrophulariaceae	*Eremophila latrobei* subsp. *glabra*																																																					X								X				X														X									
Scrophulariaceae	*Eremophila longifolia*						X	X					X	X																																											X																								X				X			
Solanaceae	*Nicotiana occidentalis* subsp. *obliqua*																		X	X	X	X			X						X		X																																																			
Solanaceae	*Nicotiana* sp.															X		X	X	X											X	X	X		X																																																	
Solanaceae	*Solanum diversiflorum*							X	X								X				X	X			X	X		X					X																																																X	X			
Solanaceae	*Solanum horridum*	X		X				X	X								X				X											X			X						X						X		X				X																												X	X		X			X				
Solanaceae	*Solanum phlomoides*		X								X																															X												X		X																					X									
Typhaceae	*Typha domingensis*																			X	X																																																																		
Urticaceae	*Parietaria cardiostegia*																																																																																						
Violaceae	*Hybanthus aurantiacus*	X	X		X	X	X	X		X	X	X					X						X			X	X				X		X																X						X	X							X					X			X					X	X	X	X	X	X	X	X	X	X	X	X		X
Zygophyllaceae	*Tribulus hirsutus*																		X																							X																																						X					
Zygophyllaceae	*Tribulus occidentalis*																					X	X			X		X																																																				X				
Zygophyllaceae	*Tribulus platypterus*																																												X																																										
Zygophyllaceae	*Tribulus suberosus*																																						X			X			X	X				X			X		X	X																													

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	
Family	**Species**	**MCC-01**	**MCC-02**	**MCC-07**	**MCC-08**	**MCC-10**	**MCC-25**	**MCC-26**	**MCC-27**	**MCC-28**	**MCC-35**	**MCC-36**	**MCC-37**	**MCC-39**	**RC-407**	**Ecoscape Opp.**
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*															
Acanthaceae	*Rostellularia adscendens* var. *latifolia*					X						X				X
Aizoaceae	*Trianthema triquetra*				X			X	X				X			
Aizoaceae	*Trianthema triquetrum*															
Aizoaceae	*Zaleya galericulata* subsp. *galericulata*															
Amaranthaceae	*Achyranthes aspera*															
Amaranthaceae	*Aerva javanica*	X	X	X				X				X	X	X		X
Amaranthaceae	*Alternanthera angustifolia*															
Amaranthaceae	*Alternanthera nana*			X	X	X				X	X					
Amaranthaceae	*Alternanthera nodiflora*															
Amaranthaceae	*Amaranthus cuspidifolius*		X									X		X		
Amaranthaceae	*Amaranthus undulatus*	X	X	X	X	X	X	X	X	X	X	X		X		
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*					X										
Amaranthaceae	*Gomphrena cunninghamii*															
Amaranthaceae	*Ptilotus aervoides*							X								
Amaranthaceae	*Ptilotus astrolasius*															
Amaranthaceae	*Ptilotus auriculifolius*															
Amaranthaceae	*Ptilotus axillaris*										X				X	
Amaranthaceae	*Ptilotus calostachyus*															
Amaranthaceae	*Ptilotus clementii*															
Amaranthaceae	*Ptilotus exaltatus*															
Amaranthaceae	*Ptilotus fusiformis*															
Amaranthaceae	*Ptilotus helipteroides*															
Amaranthaceae	*Ptilotus incanus*															X
Amaranthaceae	*Ptilotus mollis*															X
Amaranthaceae	*Ptilotus obovatus*															
Apocynaceae	*Calotropis procera*															X
Apocynaceae	*Carissa lanceolata*			X		X				X						
Apocynaceae	*Marsdenia angustata*															
Araliaceae	*Trachymene oleracea* subsp. *oleracea*								X		X					
Asteraceae	*Calocephalus beardii*														X	
Asteraceae	*Calocephalus knappii*														X	
Asteraceae	*Centipeda minima* subsp. *macrocephala*		X							X						
Asteraceae	*Flaveria trinervia*															
Asteraceae	*Minuria integerrima*															
Asteraceae	*Pentalepis trichodesmoides* subsp. *trichodesmoides*															X
Asteraceae	*Peripleura virgata*															
Asteraceae	*Pluchea dentex*															
Asteraceae	*Pluchea ferdinandi-muelleri*			X						X			X		X	
Asteraceae	*Pluchea rubelliflora*											X				
Asteraceae	*Pluchea tetranthera*			X	X	X	X			X					X	
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*															
Asteraceae	*Pterocaulon sphacelatum*		X	X	X		X		X		X	X			X	
Asteraceae	*Pterocaulon sphaeranthoides*															
Asteraceae	*Sonchus oleraceus*					X										
Asteraceae	*Streptoglossa bubakii*															
Asteraceae	*Streptoglossa liatroides*															
Asteraceae	*Streptoglossa* sp.															
Boraginaceae	*Ehretia saligna var. saligna*															
Boraginaceae	*Heliotropium chrysocarpum*															
Boraginaceae	*Heliotropium crispatum*						X	X						X	X	
Boraginaceae	*Heliotropium cunninghamii*															
Boraginaceae	*Heliotropium heteranthum*															
Boraginaceae	*Heliotropium inexplicitum*															
Boraginaceae	*Heliotropium pachyphyllum*															
Boraginaceae	*Heliotropium skeleton*															
Boraginaceae	*Heliotropium* sp.															
Boraginaceae	*Heliotropium tenuifolium*															
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*														X	
Campanulaceae	*Wahlenbergia tumidifructa*														X	
Capparaceae	*Capparis spinosa* var. *nummularia*															
Caryophyllaceae	*Polycarpaea corymbosa*							X			X				X	
Caryophyllaceae	*Polycarpaea holtzei*															
Caryophyllaceae	*Polycarpaea longiflora*															
Celastraceae	*Stackhousia intermedia*															
Celastraceae	*Stackhousia muricata*															
Chenopodiaceae	*Dysphania plantaginella*														X	
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*							X								
Chenopodiaceae	*Dysphania sphaerosperma*															
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*															
Chenopodiaceae	*Maireana sp.*															
Chenopodiaceae	*Rhagodia eremaea*															
Chenopodiaceae	*Salsola australis*															
Chenopodiaceae	*Sclerolaena cornishiana*															X
Chenopodiaceae	*Sclerolaena costata*															
Cleomaceae	*Cleome viscosa*	X		X	X	X		X		X		X				
Convolvulaceae	*Bonamia erecta*															
Convolvulaceae	*Bonamia pilbarensis*														X	
Convolvulaceae	*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)	X														
Convolvulaceae	*Duperreya commixta*															
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*		X												X	
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	X		X	X	X	X	X	X	X	X	X	X		X	
Convolvulaceae	*Ipomoea muelleri*					X										
Convolvulaceae	*Ipomoea* sp.															
Convolvulaceae	*Operculina aequisepala*															
Convolvulaceae	*Polymeria ambigua*	X	X	X	X			X	X	X	X	X	X		X	
Cucurbitaceae	*Austrobryonia pilbarensis*															
Cucurbitaceae	*Citrullus amarus*															
Cucurbitaceae	*Cucumis melo*															
Cucurbitaceae	*Cucumis variabilis*				X			X			X	X	X			
Cyperaceae	*Bulbostylis barbata*														X	
Cyperaceae	*Bulbostylis turbinata*															
Cyperaceae	*Cyperus bifax*															
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*															

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	EvApyCcl	
Family	**Species**	**MCC-01**	**MCC-02**	**MCC-07**	**MCC-08**	**MCC-10**	**MCC-25**	**MCC-26**	**MCC-27**	**MCC-28**	**MCC-35**	**MCC-36**	**MCC-37**	**MCC-39**	**RC-407**	**Ecoscape Opp.**
Cyperaceae	*Cyperus difformis*															
Cyperaceae	*Cyperus iria*															
Cyperaceae	*Cyperus ixiocarpus*															
Cyperaceae	*Cyperus squarrosus*															
Cyperaceae	*Cyperus vaginatus*		X		X	X	X	X	X	X	X			X		
Cyperaceae	*Fimbristylis dichotoma*															
Cyperaceae	*Fimbristylis microcarya*															
Cyperaceae	*Fimbristylis simulans*															
Cyperaceae	*Schoenoplectiella laevis*															
Cyperaceae	*Schoenoplectus subulatus*															
Elatinaceae	*Bergia pedicellaris*															X
Euphorbiaceae	*Adriana tomentosa var. tomentosa*															
Euphorbiaceae	*Euphorbia alsiniflora*				X	X	X	X	X	X						
Euphorbiaceae	*Euphorbia australis*	X	X		X		X	X	X	X	X	X		X	X	
Euphorbiaceae	*Euphorbia biconvexa*	X	X	X							X	X	X	X		
Euphorbiaceae	*Euphorbia boophthona*															
Euphorbiaceae	*Euphorbia careyi*															
Euphorbiaceae	*Euphorbia hirta*															
Euphorbiaceae	*Euphorbia schultzii*															
Euphorbiaceae	*Euphorbia* sp.															
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*								X							
Euphorbiaceae	*Euphorbia trigonosperma*														X	
Fabaceae	*Acacia acradenia*				X		X	X			X		X			
Fabaceae	*Acacia adoxa var. adoxa*															
Fabaceae	*Acacia adsurgens*															
Fabaceae	*Acacia ampliceps*							X								
Fabaceae	*Acacia ancistrocarpa*															
Fabaceae	*Acacia aphanoclada*															X
Fabaceae	*Acacia aphanoclada x pyrifolia* var. *pyrifolia*															
Fabaceae	*Acacia bivenosa*	X	X	X	X		X	X	X	X	X		X	X	X	
Fabaceae	*Acacia colei* var. *colei*															
Fabaceae	*Acacia coriacea* subsp. *pendens*															
Fabaceae	*Acacia eriopoda*															
Fabaceae	*Acacia holosericea*															
Fabaceae	*Acacia inaequilatera*															
Fabaceae	*Acacia maitlandii*															
Fabaceae	*Acacia monticola*															
Fabaceae	*Acacia orthocarpa*														X	
Fabaceae	*Acacia pruinocarpa*															
Fabaceae	*Acacia ptychophylla*															
Fabaceae	*Acacia pyrifolia* agg.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Fabaceae	*Acacia retivenea* subsp. *clandestina*															
Fabaceae	*Acacia* sp.															
Fabaceae	*Acacia synchronicia*			X												
Fabaceae	*Acacia tenuissima*															X
Fabaceae	*Acacia trachycarpa*	X	X	X		X	X	X	X	X			X	X		
Fabaceae	*Acacia trachycarpa x tumida* var. *pilbarensis*															X
Fabaceae	*Acacia tumida* var. *pilbarensis*			X	X		X				X	X				
Fabaceae	*Aeschynomene indica*								X							
Fabaceae	*Alysicarpus muelleri*					X	X		X						X	
Fabaceae	*Crotalaria medicaginea* var. *neglecta*	X					X	X	X	X				X	X	
Fabaceae	*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*															
Fabaceae	*Crotalaria* sp.						X									
Fabaceae	*Cullen graveolens*															
Fabaceae	*Cullen leucanthum*					X										
Fabaceae	*Cullen leucochaites*															
Fabaceae	*Desmodium muelleri*															
Fabaceae	*Gastrolobium grandiflorum*															
Fabaceae	*Glycine canescens*				X											
Fabaceae	*Gompholobium oreophilum*															
Fabaceae	*Indigastrum parviflorum*															
Fabaceae	*Indigofera colutea*					X	X		X		X				X	
Fabaceae	*Indigofera linifolia*			X		X			X	X		X		X	X	
Fabaceae	*Indigofera linnaei*									X					X	
Fabaceae	*Indigofera monophylla*			X			X	X	X	X	X	X			X	
Fabaceae	*Indigofera rugosa*												X			
Fabaceae	*Indigofera* sp.															
Fabaceae	*Indigofera trita* subsp. *trita*				X	X				X				X		
Fabaceae	*Isotropis atropurpurea*														X	
Fabaceae	*Neptunia dimorphantha*								X	X						
Fabaceae	*Petalostylis labicheoides*	X	X													
Fabaceae	*Rhynchosia minima*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Fabaceae	*Senna artemisioides* subsp. *helmsii*														X	
Fabaceae	*Senna artemisioides* subsp. *oligophylla*			X									X			
Fabaceae	*Senna artemisioides* subsp. *oligophylla x helmsii*															
Fabaceae	*Senna glutinosa* subsp. *glutinosa*															
Fabaceae	*Senna glutinosa* subsp. *glutinosa x luerssenii*															
Fabaceae	*Senna glutinosa* subsp. *pruinosa*															
Fabaceae	*Senna notabilis*		X	X					X		X				X	
Fabaceae	*Senna symonii*															
Fabaceae	*Senna venusta*															
Fabaceae	*Sesbania cannabina*				X	X				X						
Fabaceae	*Swainsona decurrens*															
Fabaceae	*Swainsona formosa*						X								X	
Fabaceae	*Swainsona stenodonta*															
Fabaceae	*Tephrosia clementii*															
Fabaceae	*Tephrosia densa*															
Fabaceae	*Tephrosia rosea* var. *clementii*	X	X	X			X	X		X	X	X	X		X	
Fabaceae	*Tephrosia* sp.															
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 1161)														X	
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 356)															
Fabaceae	*Tephrosia virens*			X												
Fabaceae	*Vachellia farnesiana*									X					X	
Fabaceae	*Vigna lanceolata* var. *lanceolata*	X	X				X			X						

Table 24: Flora inventory (site x species) for all quadrats in the survey area

	Vegetation type	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	
Family	Species	MCC-01	MCC-02	MCC-07	MCC-08	MCC-10	MCC-25	MCC-26	MCC-27	MCC-28	MCC-35	MCC-36	MCC-37	MCC-39	RC-407	Ecoscape Opp.
Goodeniaceae	*Dampiera candicans*															
Goodeniaceae	*Goodenia cusackiana*															
Goodeniaceae	*Goodenia lamprosperma*															X
Goodeniaceae	*Goodenia microptera*												X		X	
Goodeniaceae	*Goodenia muelleriana*								X							
Goodeniaceae	*Goodenia nuda*														X	
Goodeniaceae	*Goodenia stobbsiana*															
Goodeniaceae	*Goodenia triodiophila*															
Goodeniaceae	*Scaevola amblyanthera* var. *centralis*								X		X	X				
Goodeniaceae	*Scaevola browniana* subsp. *browniana*															
Goodeniaceae	*Scaevola spinescens*															
Haloragaceae	*Haloragis gossei*														X	
Lamiaceae	*Clerodendrum floribundum*															
Lamiaceae	*Clerodendrum tomentosum* var. *lanceolatum*															
Lauraceae	*Cassytha capillaris*															
Loranthaceae	*Amyema preissii*															
Loranthaceae	*Amyema sanguinea* var. *sanguinea*				X		X									
Lythraceae	*Ammannia baccifera*						X									
Lythraceae	*Ammannia multiflora*						X									
Malvaceae	*Abutilon fraseri*															
Malvaceae	*Abutilon lepidum*															
Malvaceae	*Abutilon macrum*															
Malvaceae	*Abutilon malvifolium*		X													
Malvaceae	*Abutilon oxycarpum* subsp. Prostrate (A.A. Mitchell PRP 1266)															
Malvaceae	*Abutilon* sp.															
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)															
Malvaceae	*Androcalva luteiflora*															
Malvaceae	*Corchorus crozophorifolius*															
Malvaceae	*Corchorus lasiocarpus* subsp. *lasiocarpus*	X		X	X	X	X		X	X	X	X	X	X		
Malvaceae	*Corchorus parviflorus*						X	X	X	X					X	
Malvaceae	*Corchorus* sp.															
Malvaceae	*Corchorus tridens*							X	X	X						
Malvaceae	*Gossypium australe*		X	X	X		X	X	X	X	X	X	X		X	
Malvaceae	*Gossypium robinsonii*			X								X				
Malvaceae	*Hibiscus austrinus* var. *austrinus*				X											
Malvaceae	*Hibiscus coatesii*															
Malvaceae	*Hibiscus goldsworthii*															
Malvaceae	*Hibiscus leptocladus*															
Malvaceae	*Hibiscus* sp.		X	X							X	X		X		
Malvaceae	*Hibiscus sturtii* agg.														X	
Malvaceae	*Malvastrum americanum*				X	X	X		X	X						
Malvaceae	*Melhania oblongifolia*				X		X	X	X	X				X		
Malvaceae	*Seringia nephrosperma*															
Malvaceae	*Seringia* sp.															
Malvaceae	*Sida ?arenicola*															
Malvaceae	*Sida ?macropoda* (complex)															
Malvaceae	*Sida aff. fibulifera*															
Malvaceae	*Sida clementii*														X	
Malvaceae	*Sida echinocarpa*		X	X				X	X		X					
Malvaceae	*Sida fibulifera*		X	X	X	X		X	X	X		X	X	X	X	
Malvaceae	*Sida macropoda*															X
Malvaceae	*Sida rohlenae* subsp. *rohlenae*		X	X			X				X	X		X	X	
Malvaceae	*Sida* sp. Articulation below (A.A. Mitchell PRP 165)															
Malvaceae	*Sida* sp. Excedentifolia (J.L. Egan 1925)															
Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)															
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/9)															
Malvaceae	*Sida* sp. verrucose glands (F.H. Mollemans 2423)															
Malvaceae	*Triumfetta chaetocarpa*													X	X	
Malvaceae	*Triumfetta clementii*		X							X	X	X		X		
Malvaceae	*Triumfetta maconochieana*															
Malvaceae	*Triumfetta propinqua*															
Malvaceae	*Waltheria indica*															
Malvaceae	*Waltheria virgata*															
Marsileaceae	*Marsilea hirsuta*					X				X						
Menispermaceae	*Tinospora smilacina*															
Molluginaceae	*Trigastrotheca molluginea*												X		X	
Moraceae	*Ficus brachypoda*															
Myrtaceae	*Corymbia candida* subsp. *dipsodes*															
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*															
Myrtaceae	*Corymbia ferriticola*															
Myrtaceae	*Corymbia hamersleyana*		X	X	X		X	X	X	X	X	X	X	X		
Myrtaceae	*Eucalyptus camaldulensis*															
Myrtaceae	*Eucalyptus leucophloia* subsp. *leucophloia*															
Myrtaceae	*Eucalyptus victrix*	X	X	X	X	X	X	X	X	X	X		X	X	X	
Myrtaceae	*Melaleuca bracteata*	X	X		X		X		X					X		
Myrtaceae	*Melaleuca glomerata*				X	X	X									
Nyctaginaceae	*Boerhavia burbidgeana*															
Nyctaginaceae	*Boerhavia coccinea*												X			
Nyctaginaceae	*Boerhavia gardneri*	X	X		X	X		X	X							
Nyctaginaceae	*Boerhavia repleta*			X							X	X		X		
Nyctaginaceae	*Boerhavia schomburgkiana*				X	X		X		X						
Oleaceae	*Jasminum didymum* subsp. *lineare*						X									
Papavaceae	*Argemone ochroleuca*															
Phyllanthaceae	*Notoleptopus decaisnei*					X		X	X	X					X	
Phyllanthaceae	*Phyllanthus erwinii*															
Phyllanthaceae	*Phyllanthus maderaspatensis*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Plantaginaceae	*Stemodia grossa*		X		X	X	X					X				
Poaceae	*Amphipogon sericeus*															
Poaceae	*Aristida contorta*															
Poaceae	*Aristida holathera* var. *holathera*														X	
Poaceae	*Aristida hygrometrica*															
Poaceae	*Aristida latifolia*															
Poaceae	*Bothriochloa ewartiana*									X						
Poaceae	*Brachyachne convergens*															

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	Vegetation type	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	EvApyCci	
Family	Species	MCC-01	MCC-02	MCC-07	MCC-08	MCC-10	MCC-25	MCC-26	MCC-27	MCC-28	MCC-35	MCC-36	MCC-37	MCC-39	RC-407	Ecoscape Opp.	
Poaceae	*Brachyachne prostrata*																
Poaceae	*Cenchrus ciliaris*	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Poaceae	*Cenchrus setiger*														X		
Poaceae	*Chloris barbata*																
Poaceae	*Chloris pectinata*																
Poaceae	*Chloris pumilio*					X											
Poaceae	*Chrysopogon fallax*	X	X	X	X	X	X	X	X	X	X	X	X		X		
Poaceae	*Cymbopogon ambiguus*	X		X			X	X		X	X	X	X	X			
Poaceae	*Cynodon dactylon*				X												
Poaceae	*Dactyloctenium radulans*			X	X	X			X				X	X			
Poaceae	*Dichanthium sericeum* subsp. *humilius*								X								
Poaceae	*Digitaria brownii*																
Poaceae	*Digitaria ctenantha*																
Poaceae	*Echinochloa colona*				X	X			X	X							
Poaceae	*Enneapogon caerulescens*																
Poaceae	*Enneapogon lindleyanus*					X	X										
Poaceae	*Enneapogon polyphyllus*																
Poaceae	*Enneapogon robustissimus*	X	X	X							X	X	X				
Poaceae	*Enteropogon ramosus*																
Poaceae	*Eragrostis crateriformis*																
Poaceae	*Eragrostis cumingii*				X	X	X		X		X				X		
Poaceae	*Eragrostis desertorum*														X		
Poaceae	*Eragrostis eriopoda*										X	X					
Poaceae	*Eragrostis leptocarpa*					X			X								
Poaceae	*Eragrostis setifolia*																
Poaceae	*Eragrostis tenellula*				X	X	X		X	X							
Poaceae	*Eriachne avenacea*																
Poaceae	*Eriachne benthamii*	X			X	X	X	X	X	X	X	X		X			
Poaceae	*Eriachne ciliata*																
Poaceae	*Eriachne lanata*																
Poaceae	*Eriachne mucronata*																
Poaceae	*Eriachne obtusa*																
Poaceae	*Eriachne pulchella* subsp. *dominii*																
Poaceae	*Eriochloa pseudoacrotricha*																
Poaceae	*Eulalia aurea*																
Poaceae	*Heteropogon contortus*																
Poaceae	*Iseilema dolichotrichum*																
Poaceae	*Leptochloa fusca* subsp. *fusca*				X	X											
Poaceae	*Panicum decompositum*				X	X											
Poaceae	*Paraneurachne muelleri*										X				X		
Poaceae	*Paspalidium clementii*								X								
Poaceae	*Paspalidium rarum*																
Poaceae	*Paspalidium tabulatum*																
Poaceae	*Perotis rara*								X		X						
Poaceae	*Schizachyrium fragile*																
Poaceae	*Setaria surgens*																
Poaceae	*Setaria verticillata*																
Poaceae	*Sporobolus actinocladus*																X
Poaceae	*Sporobolus australasicus*		X		X	X	X	X	X								
Poaceae	*Themeda avenacea*		X														
Poaceae	*Themeda triandra*			X			X	X	X	X	X	X					
Poaceae	*Tragus australianus*																
Poaceae	*Triodia angusta*																
Poaceae	*Triodia brizoides*																
Poaceae	*Triodia epactia*														X		
Poaceae	*Triodia longiceps*	X	X	X	X	X			X	X	X		X	X	X		
Poaceae	*Triodia wiseana*	X		X	X			X	X	X	X		X				
Poaceae	*Tripogon loliiformis*																
Poaceae	*Yakirra australiensis* var. *australiensis*																
Polygalaceae	*Polygala glaucifolia*																
Polygalaceae	*Polygala isingii*																
Portulacaceae	*Portulaca oleracea*		X	X		X		X	X	X	X				X		
Portulacaceae	*Portulaca pilosa*											X					
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*																
Proteaceae	*Grevillea wickhamii* agg.			X				X			X	X					
Proteaceae	*Hakea chordophylla*																
Proteaceae	*Hakea lorea subsp. lorea*								X				X		X		
Pteridaceae	*Cheilanthes brownii*																
Rubiaceae	*Oldenlandia crouchiana*																
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*																
Santalaceae	*Santalum lanceolatum*																
Sapindaceae	*Atalaya hemiglauca*	X	X	X	X	X		X	X	X			X	X			
Sapindaceae	*Dodonaea coriacea*																
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*																
Scrophulariaceae	*Eremophila latrobei* subsp. *glabra*																
Scrophulariaceae	*Eremophila longifolia*		X								X	X					
Solanaceae	*Nicotiana occidentalis* subsp. *obliqua*					X	X				X			X	X		
Solanaceae	*Nicotiana* sp.				X	X				X							
Solanaceae	*Solanum diversiflorum*				X	X	X	X	X	X	X	X			X		
Solanaceae	*Solanum horridum*				X		X	X	X	X	X	X					
Solanaceae	*Solanum phlomoides*																
Typhaceae	*Typha domingensis*																
Urticaceae	*Parietaria cardiostegia*																
Violaceae	*Hybanthus aurantiacus*	X		X			X	X			X	X			X		
Zygophyllaceae	*Tribulus hirsutus*							X	X	X							
Zygophyllaceae	*Tribulus occidentalis*			X								X					
Zygophyllaceae	*Tribulus platypterus*																
Zygophyllaceae	*Tribulus suberosus*																

Table 25: Vegetation type collation

Number of Woodman (2019a) quadrats per Woodman vegetation type and their inclusion in Ecoscape vegetation types

Woodman vegetation types/ Ecoscape vegetation types		1	2	3	4	5	6	7	8	9	10	13	14	15	16
AiTw1	*Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* hummock grassland								**4**	**8**					
AiTw2	*Acacia inaequilatera* and *A. bivenosa* mid isolated shrubs over *Triodia wiseana* and *T. longiceps* mid hummock grassland								**4**						
AoTl	*Acacia orthocarpa*, *A. monticola* and *A. bivenosa* low sparse shrubland over *Triodia longiceps* and *T. epactia* low hummock grassland														
AsTe	*Acacia synchronicia*, *A. bivenosa*, *A. inaequilatera* tall open shrubland over *Triodia epactia* low open hummock grassland														
AsTl	*Acacia synchronicia* mid isolated shrubs over *Triodia longiceps* and *Triodia wiseana* mid sparse hummock grassland								**6**						
AtTe	*Acacia trachycarpa* low sparse mallee shrubland over *Triodia epactia* and *T. brizoides* open hummock grassland														
CcaAiTe	*Corymbia candida* subsp. *dipsodes*, *C. hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia inaequilatera*, *Grevillea wickhamii* subsp. *hispidula* and *Hakea chordophylla* tall isolated shrubs over *Triodia epactia* low hummock grassland			**4**											
ChAiTa	*Corymbia hamersleyana* low isolated trees over *Acacia inaequilatera* tall isolated shrubs over *Triodia angusta* and *T. wiseana* low hummock grassland										**3**				
ChAiTe	*Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low woodland over *Acacia inaequilatera*, *A. bivenosa* and *Indigofera monophylla* low isolated shrubland over *Triodia epactia* low hummock grassland	**12**	**2**					**1**							
ChAiTw	*Corymbia hamersleyana* low isolated clumps of trees over *Acacia inaequilatera*, *A. bivenosa* mid open shrubland over *Triodia wiseana* low hummock grassland		**1**						**1**	**1**	**1**				
ChAmTe	*Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia monticola*, *A. tumida* var. *pilbarensis*, and *Grevillea wickhamii*. tall open shrubland over *Triodia epactia* and *Eriachne lanata* low open hummock/ tussock grassland			**8**		**3**									
ChApyTt	*Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* and *Acacia tumida* var. *pilbarensis* tall							**6**							

Woodman vegetation types/ Ecoscape vegetation types		1	2	3	4	5	6	7	8	9	10	13	14	15	16
	shrubland over *Themeda triandra*, *Triodia longiceps* and *Chrysopogon fallax* tall tussock grassland/hummock grassland														
EcApyCci	*Eucalyptus camaldulensis* and *Eucalyptus victrix* mid woodland over *Acacia pyrifolia*, *Atalaya hemiglauca* and *Acacia trachycarpa* tall open shrubland over **Cenchrus ciliaris* and *Cyperus vaginata* low tussock grassland/sedgeland											5	8	13	
ElAbTe	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia bivenosa*, *A. ptychophylla* and *A. monticola* mid shrubland over *Triodia brizoides, T. epactia* and *Cymbopogon ambiguus* mid hummock/tussock grassland	10													
ElAmTb	*Eucalyptus leucophloia* subsp. *leucophloia* low woodland over *Acacia monticola* mid isolated clumps of shrubs over *Triodia brizoides* and *T. epactia* low hummock grassland						2								
ElAmTe	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia monticola*, *A. bivenosa* and *Grevillea wickhamii* shrubland over *Triodia epactia*, *Eriachne lanata* mid hummock/tussock grassland				2										
ElApTe	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* low woodland over *Acacia ptychophylla*, *A. inaequilatera* and *Indigofera monophylla* low isolated shrubland over *Triodia epactia*, *T. brizoides* low hummock grassland	12													
ElGwTe	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated clumps over *Senna glutinosa* subsp. *glutinosa* and *Grevillea wickhamii* tall open shrubland over *Triodia epactia* and *Eriachne mucronata* mid hummock grassland/ mid isolated clumps of tussock grasses						4								
EvApyCci	*Eucalyptus victrix* and *Corymbia hamersleyana* mid open woodland over *Acacia pyrifolia*, *Acacia trachycarpa* and *Acacia tumida* var. *pilbarensis* tall shrubland over **Cenchrus ciliaris*, *Triodia longiceps* and *Cyperus vaginata* low tussock grassland/hummock grassland/sedgeland							5				7		6	1

APPENDIX FOUR FLORISTIC QUADRAT DATA

Ecoscape 2020 survey only. Woodman reports should be viewed for earlier quadrat records.

MC20OP01

Staff JLT **Date** 10/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 204101 **mE** 7607872 **mN** **Lat.** -21.6077 **Long.** 120.1420

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Orange brown clay

Rock Type Ironstone

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 40 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia synchronicia*,^*Acacia bivenosa*\^shrub\4\i;G ^*Triodia brizoides*,^*Triodia longiceps*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes Small size but very different

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.3	<18	
Acacia synchronicia		2.5	22	
Aristida contorta		0.15	<1	
Boerhavia coccinea		0.15	<1	
Bulbostylis barbata		0.1	<1	

Cleome viscosa	0.3	<1
Eriachne pulchella subsp. *dominii*	0.1	<1
Fimbristylis simulans	0.05	<1
Goodenia microptera	0.3	<1
Goodenia stobbsiana	0.2	<1
Hibiscus sturtii var. *platychlamys*	0.35	<1
Indigofera monophylla	0.5	<1
Paraneurachne muelleri	0.4	<1
Portulaca oleracea	0.05	<1
Ptilotus astrolasius	0.2	<1
Ptilotus calostachyus	0.45	<1
Ptilotus clementii	0.15	<1
Ptilotus exaltatus	0.05	<1
Scaevola spinescens	1.69	<1
Sclerolaena cornishiana	0.3	<1
Senna glutinosa subsp. *glutinosa* x *luerssenii*	1.2	<1
Senna glutinosa subsp. *pruinosa*	1	<1
Sida echinocarpa	0.3	<1
Sporobolus australasicus	0.15	<1
Tribulus suberosus	0.6	<1
Trigastrotheca molluginea	0.15	<1
Triodia brizoides	0.3	28
Triodia longiceps	0.4	3

MC20OP02

Staff JLT **Date** 11/04/2020 **Season** E

Revisit

Type Q 100 m x 25 m

Location

MGA Zone 51 202132 **mE** 7605024 **mN** **Lat.** -21.6331 **Long.** 120.1225

Habitat Minor creek

Aspect W **Slope** Very Gentle

Soil Type Brown sand

Rock Type Silcrete

Loose Rock 2-10 % cover; 2-6 mm in size **Litter** 2 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** <1 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree mallee\6\r;M ^^*Acacia tumida* var. *pilbarensis*,*Acacia acradenia*,*Grevillea wickhamii*\^shrub\4\i;G ^^*Themeda triandra*,*Triodia longiceps*,*Triodia epactia*\^tussock grass,hummock grass\2\i

Veg. Condition Very Good

Disturbance Some cattle tracks

Fire Age 2-5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		2.2	1	
Acacia bivenosa		1.3	<1	
Acacia orthocarpa		0.7	<1	
Acacia pyrifolia var. *pyrifolia*		1	<1	

Acacia trachycarpa	1.2	<1
Acacia tumida var. *pilbarensis*	2.3	3
Achyranthes aspera	0.3	<1
**Aerva javanica*	0.2	<1
Boerhavia gardneri	0.6	<1
Bonamia pilbarensis	0.3	<1
**Cenchrus ciliaris*	0.3	<1
Cleome viscosa	0.1	<1
Corchorus crozophorifolius	0.2	<1
Corchorus lasiocarpus	0.4	<1
Corchorus parviflorus	0.2	<1
Corymbia hamersleyana	4	2.5
Cucumis variabilis	0.2	<1
Cymbopogon ambiguus	0.2	<1
Dampiera candicans	0.3	<1
Enneapogon lindleyanus	0.5	<1
Evolvulus alsinoides var. *decumbens*	0.2	<1
Goodenia cusackiana	0.1	<1
Goodenia stobbsiana	0.1	<1
Gossypium australe	0.6	<1
Grevillea wickhamii	2	2
Grevillea wickhamii	1	<1
Heliotropium cunninghamii	0.3	<1
Hibiscus coatesii	0.4	<1
Hybanthus aurantiacus	0.3	<1
Melhania oblongifolia	0.4	<1
Paraneurachne muelleri	0.2	<1
Polymeria ambigua	0.2	<1
Ptilotus exaltatus	0.3	<1
Rhynchosia minima	0.2	<1
Scaevola amblyanthera var. *centralis*	0.2	<1
Scaevola spinescens	1	<1
Senna glutinosa subsp. *glutinosa*	0.5	<1
Sida echinocarpa	0.4	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	<1
Stemodia grossa	0.2	<1
Themeda triandra	.45	5
Trigastrotheca molluginea	0.1	<1

Triodia epactia	.4	1
Triodia longiceps	.4	3
Waltheria virgata	0.3	<1

MC20OP03

Staff JLT **Date** 13/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 201804 **mE** 7604141 **mN** **Lat.** -21.6410 **Long.** 120.1192

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Red sandy clay

Rock Type Ironstone

Loose Rock 2-10 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 65 % cover **Weeds** 0 % cover

Vegetation M+ ^^*Acacia synchronicia*,*Acacia bivenosa*,*Acacia inaequilatera*\^shrub\4\i;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		.4	<1	
Acacia bivenosa		1.8	5	
Acacia inaequilatera		4	2	
Acacia synchronicia		2	21	
Aristida contorta		.25	<1	

Cleome viscosa	.25	<1
Corchorus parviflorus	.4	<1
Eriachne pulchella subsp. *dominii*	.1	<1
Euphorbia sp.	.14	<1
Goodenia muelleriana	.2	<1
Gossypium australe	.4	<1
Hibiscus coatesii	.2	<1
Indigofera monophylla	.5	<1
Ptilotus calostachyus	.3	<1
Rhynchosia minima	.5	<1
Senna glutinosa subsp. *glutinosa* x *luerssenii*	1.5	<1
Senna symonii	.4	<1
Senna symonii	1.5	<1
Sida echinocarpa	.35	<1
Sida fibulifera	.35	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.15	<1
Sporobolus australasicus	.15	<1
Themeda triandra	.6	<1
Trigastrotheca molluginea	.2	<1
Triodia epactia	.4	18
Triumfetta clementii	.35	<1

MC20OP04

Staff JLT **Date** 14/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197489 **mE** 7607244 **mN** **Lat.** -21.6123 **Long.** 120.0781

Habitat Minor hill

Aspect N/A **Slope** N/A

Soil Type Orange clay loam

Rock Type Ironstone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 65 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree mallee\6\r;M ^*Senna symonii*\^shrub\5\bi;G ^*Triodia brizoides*,^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia monticola		1	<1	
Acacia ptychophylla		.3	<1	
Acacia pyrifolia var. *morrisonii*		.3	<1	
Bonamia pilbarensis		.2	<1	
Corchorus parviflorus		.8	<1	

Corymbia hamersleyana	4	<1
Eriachne ciliata	.15	<1
Eriachne mucronata	.4	<1
Eucalyptus leucophloia subsp. *leucophloia*	6	3.5
Fimbristylis dichotoma	.15	<1
Fimbristylis simulans	.15	<1
Goodenia stobbsiana	0.2	<1
Grevillea wickhamii	1	<1
Hakea lorea subsp. *lorea*	.8	<1
Indigofera monophylla	.4	<1
Pluchea tetranthera	.4	<1
Ptilotus calostachyus	.5	<1
Senna glutinosa subsp. *glutinosa*	.8	<1
Senna symonii	1	1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	.1.4	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	.05	<1
Tribulus suberosus	.6	<1
Trigastrotheca molluginea	.15	<1
Triodia brizoides	.35	13
Triodia epactia	.45	8

MC20OP05

Staff JLT **Date** 14/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197969 **mE** 7607583 **mN** **Lat.** -21.6093 **Long.** 120.0828

Habitat Crest

Aspect SE **Slope** N/A

Soil Type Brown loam clay

Rock Type Ironstone

Loose Rock 20-50 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*,^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\i;M ^*Acacia inaequilatera*,^*Hakea lorea* subsp. *lorea*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia inaequilatera		2.8	1.5	
Acacia ptychophylla		.3	<1	
Acacia pyrifolia var. *morrisonii*		2	<1	
Bonamia pilbarensis		.2	<1	
Clerodendrum floribundum var. *angustifolium*		1.3	<1	

Corchorus parviflorus	.3	<1
Corymbia hamersleyana	5	2
Dampiera candicans	.45	<1
Eriachne ciliata	.1	<1
Eriachne pulchella subsp. *dominii*	.05	<1
Eucalyptus leucophloia subsp. *leucophloia*	4	3
Fimbristylis dichotoma	.3	<1
Fimbristylis simulans	.12	<1
Goodenia stobbsiana	.3	<1
Goodenia triodiophila	.45	<1
Grevillea wickhamii	1	<1
Hakea lorea subsp. *lorea*	5	1
Hibiscus sturtii var. *campylochlamys*	.4	<1
Indigofera monophylla	.5	<1
Ptilotus calostachyus	.4	<1
Senna glutinosa subsp. *glutinosa*	1.2	<1
Senna glutinosa subsp. *pruinosa*	1.2	<1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.45	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.3	<1
Trigastrotheca molluginea	.25	<1
Triodia epactia	.45	30

MC20OP06

Staff JLT **Date** 14/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197182 **mE** 7608289 **mN** **Lat.** -21.6028 **Long.** 120.0753

Habitat Upper-Slope

Aspect S **Slope** Steep

Soil Type Sandy loam

Rock Type Iron stone

Loose Rock 50-90 % cover; 6-20 mm in size **Litter** 2 % cover ; 0 cm in depth

Bare ground 70 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\r;M ^*Acacia inaequilatera*\^shrub\4\bi;G ^, ^*Triodia epactia*\^,hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia inaequilatera		3	1.5	
Clerodendrum tomentosum var. *lanceolatum*		0.2	<1	
Corchorus parviflorus		0.2	<1	
Cymbopogon ambiguus		0.4	<1	
Eremophila forrestii		0.2	<1	

Eriachne mucronata	0.3	<1
Eucalyptus leucophloia subsp. *leucophloia*	7	3
Evolvulus alsinoides var. *villosicalyx*	0.1	<1
Goodenia stobbsiana	0.1	<1
Goodenia triodiophila	0.2	<1
Gossypium australe	1	<1
Indigofera monophylla	0.7	<1
Senna glutinosa subsp. *glutinosa*	1	<1
Senna symonii	0.2	<1
Sida fibulifera	0.2	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.3	<1
Trichodesma zeylanicum var. *zeylanicum*	0.3	<1
Triodia brizoides	.4	15
Triodia epactia	0.3	5

MC20OP07

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200408 **mE** 7602566 **mN** **Lat.** -21.6550 **Long.** 120.1054

Habitat Upper-Slope

Aspect S **Slope** Steep

Soil Type Orange loam clay

Rock Type Ironstone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\bi;M ^^*Acacia monticola*,*Acacia coriacea* subsp. *pendens*,*Senna symonii*\^shrub\4\bi;G ^*Triodia brizoides*,^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age 2-5 years

Notes On steep upper slope

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *pendens*		2.5	.8	
Acacia monticola		1.5	3	
Acacia pyrifolia		.4	<1	
Bonamia pilbarensis		.2	<1	

Cheilanthes brownii	.2	<1
Cymbopogon ambiguus	.3	<1
Duperreya commixta	.1	<1
Enneapogon lindleyanus	.4	<1
Eremophila latrobei	.3	<1
Eriachne ciliata	.2	<1
Eriachne mucronata	.3	<1
Eucalyptus leucophloia subsp. *leucophloia*	5	1.5
Fimbristylis dichotoma	.15	<1
Goodenia cusackiana	.1	<1
Hibiscus coatesii	.3	<1
Hybanthus aurantiacus	.3	<1
Indigofera monophylla	.5	<1
Indigofera monophylla	.3	<1
Melhania oblongifolia	.3	<1
Pluchea tetranthera	.3	<1
Ptilotus calostachyus	.3	<1
Ptilotus exaltatus	.3	<1
Ptilotus obovatus	.4	<1
Senna glutinosa subsp. *glutinosa*	1	<1
Senna symonii	1.3	1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1.7	<1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.3	<1
Solanum phlomoides	.4	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	.15	<1
Triodia brizoides	.35	24
Triodia epactia	.4	4

MC20OP08

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200392 **mE** 7601283 **mN** **Lat.** -21.6666 **Long.** 120.1050

Habitat Minor hill

Aspect S **Slope** Very Gentle

Soil Type Brown sandy clay

Rock Type Ironstone

Loose Rock 10-20 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 55 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\bi;M ^*Acacia inaequilatera*\^shrub\4\bi;G ^^*Triodia epactia*, *Heliotropium tenuifolium*,*Indigofera monophylla*\^hummock grass,forb,shrub\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		.3	<1	
Acacia bivenosa		.3	<1	
Acacia inaequilatera		2.8	1.5	
Acacia orthocarpa		1.6	<1	
Acacia ptychophylla		.25	<1	

Bonamia pilbarensis	.15	<1
Corchorus parviflorus	.5	<1
Corymbia hamersleyana	6	1
Eriachne mucronata	.35	<1
Evolvulus alsinoides var. *villosicalyx*	.25	<1
Fimbristylis simulans	.05	<1
Goodenia stobbsiana	.15	<1
Hakea chordophylla	.4	<1
Heliotropium tenuifolium	.3	1.2
Hibiscus sturtii var. *campylochlamys*	.25	<1
Indigofera monophylla	.4	1
Polymeria ambigua	.15	<1
Ptilotus astrolasius	.45	<1
Ptilotus calostachyus	.4	<1
Scaevola amblyanthera var. *centralis*	.2	<1
Senna glutinosa subsp. *glutinosa*	1.2	<1
Senna glutinosa subsp. *pruinosa*	1.2	<1
Trichodesma zeylanicum var. *zeylanicum*	.3	<1
Trigastrotheca molluginea	.15	<1
Triodia epactia	.45	24

MC20OP09

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 100 m x 25 m

Location

MGA Zone 51 200374 **mE** 7601751 **mN** **Lat.** -21.6623 **Long.** 120.1049

Habitat Minor creek

Aspect W **Slope** Very Gentle

Soil Type Pale brown sand

Rock Type Ironstone

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 20 % cover **Weeds** <1 % cover

Vegetation M+ ^*Acacia acradenia*,^*Acacia inaequilatera*\^shrub\4\r;G ^*Triodia epactia*,^,*Indigofera rugosa*\^hummock grass,shrub\1\c

Veg. Condition Degraded

Disturbance

Fire Age >5 years

Notes Minor drainage line

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		0.5	6	
Acacia inaequilatera		1.5	1	
**Cenchrus ciliaris*		.4	<1	
Corchorus parviflorus		.5	<1	
Corymbia hamersleyana		4	<1	

Cucumis variabilis	.15	<1
Cymbopogon ambiguus	.3	<1
Dampiera candicans	.4	<1
Eriachne mucronata	.3	<1
Evolvulus alsinoides var. *decumbens*	.3	<1
Grevillea wickhamii	.6	<1
Hybanthus aurantiacus	.3	<1
Indigofera monophylla	0.25	<1
Indigofera rugosa	.3	1
Isotropis atropurpurea	.45	<1
Phyllanthus maderaspatensis	.15	<1
Polymeria ambigua	.15	<1
Scaevola amblyanthera var. *centralis*	.2	<1
Senna artemisioides subsp. *oligophylla* x *helmsii*	.35	<1
Sida echinocarpa	.4	<1
Sida fibulifera	.3	<1
Tephrosia rosea var. *clementii*	.4	<1
Themeda triandra	.4	<1
Triodia epactia	.5	35

MC20OP10

Staff JLT **Date** 17/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 196943 **mE** 7599731 **mN** **Lat.** -21.6800 **Long.** 120.0715

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Orange sandy clay

Rock Type Ironstone/quartz

Loose Rock >90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 70 % cover **Weeds** 0 % cover

Vegetation M ^*Senna symonii*\^shrub\4\bi;G+ ^^*Triodia brizoides*,*Triodia epactia*,*Triodia wiseana*\^hummock grass\1\i

Veg. Condition Very Good

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.4	<1	
Acacia ptychophylla		0.5	.3	
Acacia sp.		2	<1	
Aristida contorta		0.2	<1	
Bonamia erecta		0.15	<1	

Bonamia pilbarensis	0.2	<1
Bonamia sp. Dampier (A.A. Mitchell PRP 217)	0.2	<1
Bulbostylis barbata	0.3	<1
Corchorus parviflorus	0.3	<1
Dampiera candicans	0.4	<1
Eriachne pulchella subsp. *dominii*	0.1	<1
Fimbristylis dichotoma	0.2	<1
Fimbristylis simulans	0.1	<1
Goodenia cusackiana	0.2	<1
Goodenia microptera	0.3	<1
Goodenia stobbsiana	0.2	<1
Grevillea wickhamii	0.4	<1
Hakea chordophylla	0.5	<1
Heliotropium chrysocarpum	0.15	<1
Heliotropium skeleton	0.3	<1
Hibiscus coatesii	0.2	<1
Indigofera monophylla	0.4	<1
Maireana sp.	0.15	<1
Paspalidium rarum	0.2	<1
Pluchea dentex	0.2	<1
Polycarpaea longiflora	0.1	<1
Portulaca cyclophylla	0.1	<1
Ptilotus calostachyus	0.2	<1
Ptilotus fusiformis	0.3	<1
Scaevola amblyanthera var. *centralis*	0.2	<1
Senna glutinosa subsp. *pruinosa*	0.4	<1
Senna glutinosa subsp. x *luerssenii*	0.7	<1
Senna notabilis	0.2	<1
Senna symonii	0.3	<1
Senna symonii	1.3	1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	<1
Solanum phlomoides	0.3	<1
Sporobolus australasicus	0.2	<1
Stemodia grossa	0.2	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.2	<1
Tribulus suberosus	0.6	<1
Trigastrotheca molluginea	0.2	<1
Triodia brizoides	0.3	15

Triodia epactia	0.3	5
Triodia wiseana	0.3	1

MC20OP11

Staff JLT **Date** 17/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197118 **mE** 7599910 **mN** **Lat.** -21.6784 **Long.** 120.0732

Habitat Minor hill

Aspect N/A **Slope** N/A

Soil Type Orange clay

Rock Type Pisolite

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 55 % cover **Weeds** 0 % cover

Vegetation G+ ^*Triodia brizoides*,^*Triodia wiseana*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia adoxa var. *adoxa*		.3	<1	
Acacia ptychophylla		.35	.5	
Acacia sp.		1.2	<1	
Acacia trachycarpa		.35	<1	
Aristida contorta		.2	<1	

Bonamia erecta	.45	<1
Bonamia pilbarensis	.05	<1
Bulbostylis barbata	.15	<1
Corchorus parviflorus	.4	<1
Eriachne pulchella subsp. *dominii*	.1	<1
Fimbristylis dichotoma	.3	<1
Fimbristylis simulans	.1	<1
Goodenia stobbsiana	.3	<1
Grevillea wickhamii	.5	<1
Hakea chordophylla	.4	<1
Heliotropium chrysocarpum	.1	<1
Hibiscus sturtii var. *campylochlamys*	.4	<1
Hybanthus aurantiacus	.2	<1
Indigofera monophylla	.3	<1
Ptilotus calostachyus	.5	<1
Scaevola amblyanthera var. *centralis*	.3	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.3	<1
Trigastrotheca molluginea	.3	<1
Trigastrotheca molluginea	.3	<1
Triodia brizoides	.4	28
Triodia epactia	.45	<1
Triodia wiseana	.3	1

MC20OP12

Staff JLT **Date** 17/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199081 **mE** 7607595 **mN** **Lat.** -21.6094 **Long.** 120.0935

Habitat Minor hill

Aspect W **Slope** Gentle

Soil Type Orange brown clay

Rock Type Ironstone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 45 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\r;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		.8	<1	
Acacia inaequilatera		2.2	.6	
Bonamia pilbarensis		.05	<1	
Bulbostylis barbata		.02	<1	
Corchorus parviflorus		.4	<1	

Cymbopogon ambiguus	.4	<1
Eriachne mucronata	.2	<1
Eriachne pulchella subsp. *dominii*	.04	<1
Eucalyptus leucophloia subsp. *leucophloia*	5	2
Goodenia cusackiana	.15	<1
Goodenia stobbsiana	.4	<1
Grevillea wickhamii	.25	<1
Hakea lorea subsp. *lorea*	.3	<1
Indigofera monophylla	.3	<1
Ipomoea sp.	.2	<1
Jasminum didymum subsp. *lineare*	.4	<1
Polycarpaea holtzei	.05	<1
Ptilotus calostachyus	.4	<1
Senna glutinosa subsp. *glutinosa*	1.2	<1
Senna glutinosa subsp. *pruinosa*	1.1	<1
Senna symonii	1.4	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.3	<1
Tribulus suberosus	.6	<1
Trigastrotheca molluginea	.15	<1
Triodia epactia	.4	28

MC20OP13

Staff JLT **Date** 18/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 204346 **mE** 7613012 **mN** **Lat.** -21.5614 **Long.** 120.1453

Habitat Upper-Slope

Aspect SE **Slope** Steep

Soil Type Orange Sandy loam

Rock Type Ironstone

Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 1 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\bi;G ^*Eriachne mucronata*,^*Triodia brizoides*\^tussock grass,hummock grass\1\c

Veg. Condition Very Good

Disturbance

Fire Age >10 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia inaequilatera		0.7	<1	
Acacia ptychophylla		0.2	0.5	
**Aerva javanica*		0.2	<1	
Atalaya hemiglauca		0.2	<1	
Boerhavia gardneri		0.3	<1	

Bulbostylis barbata	0.1	<1
Cassytha capillaris	0.3	<1
Cheilanthes brownii	0.3	<1
Cleome viscosa	0.2	<1
Clerodendrum floribundum	0.3	<1
Corchorus parviflorus	0.3	<1
Corymbia hamersleyana	1	<1
Cucumis variabilis	0.2	<1
Cymbopogon ambiguus	0.3	<1
Dampiera candicans	0.3	<1
Enneapogon polyphyllus	0.2	<1
Eremophila forrestii	0.4	<1
Eremophila longifolia	0.2	<1
Eriachne avenacea	0.2	<1
Eriachne mucronata	0.3	1
Eucalyptus leucophloia subsp. *leucophloia*	5	2
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Fimbristylis dichotoma	0.2	<1
Gomphrena cunninghamii	0.3	<1
Goodenia triodiophila	0.2	<1
Gossypium australe	0.4	<1
Hakea lorea subsp. *lorea*	1	<1
Hibiscus coatesii	0.3	<1
Hybanthus aurantiacus	0.3	<1
Indigofera monophylla	0.6	<1
Isotropis atropurpurea	0.3	<1
Paraneurachne muelleri	0.3	<1
Polycarpaea holtzei	0.1	<1
Polycarpaea longiflora	0.1	<1
Ptilotus incanus	0.2	<1
Rhynchosia minima	0.3	<1
Scaevola spinescens	0.2	<1
Senna glutinosa subsp. *glutinosa*	0.6	<1
Senna glutinosa subsp. *pruinosa*	0.6	<1
Senna symonii	0.5	<1
Sida sp.	0.3	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.2	<1
Themeda triandra	0.2	<1

Tribulus suberosus	0.3	<1
Triodia brizoides	0.3	30
Waltheria virgata	0.2	<1

MC20OP14

Staff JLT **Date** 11/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 203526 **mE** 7607051 **mN** **Lat.** -21.6150 **Long.** 120.1363

Habitat Creek

Aspect E **Slope** Very Gentle

Soil Type Orange / brown clay loam

Rock Type Ironstone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus victrix*\^tree mallee\6\r;G ^^*Triodia brizoides*,*Cenchrus ciliaris*,*Triodia epactia*\^hummock grass,tussock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age 1-2 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia ptychophylla		0.3	<1	
Acacia pyrifolia var. *morrisonii*		1.5	<1	
Acacia trachycarpa		1	<1	
Bonamia pilbarensis		0.25	<1	
**Cenchrus ciliaris*		0.4	2	

**Cenchrus setiger*	0.3	<1
Corchorus parviflorus	0.2	<1
Corymbia hamersleyana	4	<1
Eriachne ciliata	0.15	<1
Eucalyptus victrix	6	3.2
Fimbristylis dichotoma	0.15	<1
Hakea lorea subsp. *lorea*	1.2	<1
Ptilotus calostachyus	0.45	<1
Senna glutinosa subsp. *glutinosa*	0.4	<1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1	<1
Tribulus suberosus	0.3	<1
Trigastrotheca molluginea	0.2	<1
Triodia brizoides	0.4	12
Triodia epactia	0.45	2

MC20Q01

Staff JLT **Date** 10/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 204109 **mE** 7607974 **mN** **Lat.** -21.6068 **Long.** 120.1421

Habitat Flat

Aspect E **Slope** Very Gentle

Soil Type Brown sandy clay ooam

Rock Type Ironstone

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 45 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\bi;M ^*Acacia inaequilatera*\^shrub\4\r;G ^*Triodia wiseana*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age 2-5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	<1	
Acacia inaequilatera		3	4	
Bulbostylis barbata		.05	<1	
Corymbia hamersleyana		3.5	2	
Eragrostis desertorum		.3	.5	

Eriachne pulchella subsp. *dominii*	.05	<1
Hakea chordophylla	.8	<1
Heliotropium ovalifolium	0.25	<1
Ptilotus calostachyus	.4	<1
Sporobolus australasicus	.15	<1
Trigastrotheca molluginea	.2	<1
Triodia longiceps	.3	<1
Triodia wiseana	.4	35

MC20Q02

Staff JLT **Date** 13/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200961 **mE** 7603445 **mN** **Lat.** -21.6472 **Long.** 120.1109

Habitat Minor hill

Aspect S **Slope** Gentle

Soil Type Brown sandy clay

Rock Type Haemotite

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 70 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\r;M ^*Acacia inaequilatera*,^*Acacia orthocarpa*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes Close to water trough

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		.2	<1	
Acacia inaequilatera		2	1	
Acacia orthocarpa		2	.8	
Acacia pyrifolia var. *pyrifolia*		.8	<1	
Corchorus parviflorus		.6	<1	

Corymbia hamersleyana	7	3
Cucumis variabilis	.1	<1
Cymbopogon ambiguus	.3	<1
Enneapogon lindleyanus	.3	<1
Eremophila longifolia	.8	<1
Eriachne mucronata	.3	<1
Euphorbia careyi	.2	<1
Evolvulus alsinoides var. *villosicalyx*	.15	<1
Goodenia microptera	.15	<1
Goodenia stobbsiana	.3	<1
Hakea chordophylla	4	.6
Heliotropium chrysocarpum	.35	<1
Heliotropium tenuifolium	.2	<1
Hibiscus sturtii var. *campylochlamys*	.35	<1
Hibiscus sturtii var. *platychlamys*	.4	<1
Hybanthus aurantiacus	.35	<1
Indigofera monophylla	.8	<1
Isotropis atropurpurea	.3	<1
Marsdenia angustata	.6	<1
Melhania oblongifolia	.4	<1
Paraneurachne muelleri	.3	<1
Senna glutinosa subsp. *glutinosa*	.1.2	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.25	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	.15	<1
Trichodesma zeylanicum var. *zeylanicum*	.5	<1
Trigastrotheca molluginea	.15	<1
Triodia epactia	.4	26
Triumfetta propinqua	.4	<1
Waltheria virgata	.6	<1

MC20Q03

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199848 **mE** 7601000 **mN** **Lat.** -21.6690 **Long.** 120.0997

Habitat Lower-Slope

Aspect S **Slope** Gentle

Soil Type Loamy clay

Rock Type White Calcrete/quartz

Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\bi;G ^*Triodia epactia*,^*Triodia longiceps*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.4	<1	
Bulbostylis barbata		0.1	<1	
Corymbia hamersleyana		1.5	<1	
Eriachne ciliata		0.2	<1	
Eucalyptus leucophloia subsp. *leucophloia*		5	1	

Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Fimbristylis dichotoma	0.1	<1
Goodenia cusackiana	0.15	<1
Goodenia stobbsiana	0.1	<1
Hakea chordophylla	0.7	<1
Heliotropium tenuifolium	0.2	<1
Hibiscus sturtii var. *campylochlamys*	0.2	<1
Indigofera monophylla	0.4	<1
Petalostylis labicheoides	0.2	<1
Ptilotus exaltatus	0.2	<1
Senna artemisioides subsp. *oligophylla* x *helmsii*	0.2	<1
Senna symonii	0.7	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.2	<1
Themeda triandra	0.3	<1
Trigastrotheca molluginea	0.15	<1
Triodia epactia	0.3	20
Triodia longiceps	0.4	1

MC20Q04

Staff JLT **Date** 13/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199486 **mE** 7604066 **mN** **Lat.** -21.6413 **Long.** 120.0968

Habitat Flat

Aspect NE **Slope** Very Gentle

Soil Type Grey/brown sandy clay

Rock Type Silcrete

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 65 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\r;M ^*Acacia inaequilatera*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		1	<1	
Acacia bivenosa		0.7	<1	
Acacia inaequilatera		4	2	
Acacia pyrifolia var. *pyrifolia*		0.3	<1	
Corchorus parviflorus		0.3	<1	

Corymbia hamersleyana	7	2.1
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Grevillea pyramidalis subsp. *leucadendron*	0.3	<1
Hakea chordophylla	0.4	<1
Heliotropium chrysocarpum	0.2	<1
Indigofera monophylla	0.5	<1
Paraneurachne muelleri	0.2	<1
Santalum lanceolatum	0.6	<1
Scaevola amblyanthera var. *centralis*	0.2	<1
Senna symonii	0.3	<1
Sida fibulifera	0.3	<1
Triodia epactia	0.3	20

MC20Q05

Staff JLT **Date** 11/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 201665 **mE** 7603862 **mN** **Lat.** -21.6435 **Long.** 120.1178

Habitat Flat

Aspect W **Slope** Very Gentle

Soil Type Orange/brown Sandy clay

Rock Type Ironstone

Loose Rock 50-90 % cover; 2-6 mm in size **Litter** 2 % cover ; <1 cm in depth

Bare ground 50 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\bi;M ^*Acacia inaequilatera*,^*Acacia acradenia*\^shrub\4\r;G ^*Triodia epactia*,^*Triodia wiseana*\^hummock grass\2\c

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		2	1	
Acacia bivenosa		0.6	<1	
Acacia inaequilatera		4	3	
Acacia synchronicia		0.5	<1	
Aristida contorta		0.2	<1	

Boerhavia gardneri	0.2	<1
Cleome viscosa	0.1	<1
Corchorus parviflorus	0.4	<1
Corymbia hamersleyana	6	1
Cymbopogon ambiguus	0.3	<1
Enneapogon caerulescens	0.1	<1
Eriachne pulchella subsp. *dominii*	0.2	<1
Goodenia muelleriana	0.2	<1
Gossypium australe	0.4	<1
Hakea lorea subsp. *lorea*	0.3	<1
Hibiscus sturtii var. *campylochlamys*	0.3	<1
Indigofera monophylla	0.5	<1
Paraneurachne muelleri	0.2	<1
Senna artemisioides subsp. *oligophylla* x *helmsii*	0.4	<1
Senna glutinosa subsp. *pruinosa*	0.6	<1
Senna glutinosa subsp. x *luerssenii*	0.5	<1
Sida echinocarpa	0.3	<1
Sida fibulifera	0.3	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.4	<1
Themeda triandra	0.4	<1
Triodia epactia	0.4	32
Triodia wiseana	0.4	2

MC20Q06

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200412 **mE** 7602546 **mN** **Lat.** -21.6552 **Long.** 120.1055

Habitat Hill

Aspect S **Slope** Steep

Soil Type Orange loam clay

Rock Type Granite

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 45 % cover **Weeds** <1 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree mallee\6\bi;M ^*Acacia monticola*\^shrub\4\i; G ^*Triodia brizoides*,^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia monticola		1.5	12	
Bonamia pilbarensis		.15	<1	
**Cenchrus ciliaris*		.3	<1	
Cheilanthes brownii		.3	<1	
Chrysopogon fallax		.4	<1	

Clerodendrum floribundum var. *angustifolium*	.5	<1
Corchorus parviflorus	.3	<1
Cucumis variabilis	.1	<1
Dampiera candicans	.4	<1
Duperreya commixta	.3	<1
Eriachne mucronata	.3	<1
Eucalyptus leucophloia subsp. *leucophloia*	5	2
Fimbristylis dichotoma	.3	<1
Goodenia triodiophila	.3	<1
Grevillea wickhamii	.6	<1
Hakea lorea subsp. *lorea*	.4	<1
Hibiscus coatesii	.3	<1
Indigofera monophylla	0.3	<1
Pluchea tetranthera	.3	<1
Ptilotus obovatus	.4	<1
Senna symonii	.4	<1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1.6	<1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.3	<1
Solanum phlomoides	.3	<1
Tribulus suberosus	.3	<1
Triodia brizoides	0.4	15
Triodia epactia	0.5	5

MC20Q07

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200205 **mE** 7602045 **mN** **Lat.** -21.6597 **Long.** 120.1034

Habitat Minor hill

Aspect SW **Slope** Moderate

Soil Type Orange sandy clay loam

Rock Type Ironstone

Loose Rock >90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\r;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia aphanoclada x *pyrifolia* var. *pyrifolia*		0.8	<1	
Acacia bivenosa		0.3	<1	
Acacia coriacea subsp. *pendens*		3	<1	
Acacia ptychophylla		0.4	<1	
Corchorus parviflorus		0.2	<1	

Dampiera candicans	0.3	<1
Eriachne mucronata	0.2	<1
Eucalyptus leucophloia subsp. *leucophloia*	6	4
Evolvulus alsinoides var. *villosicalyx*	0.15	<1
Goodenia cusackiana	0.15	<1
Goodenia triodiophila	.15	<1
Indigofera monophylla	0.5	<1
Pluchea tetranthera	0.2	<1
Ptilotus calostachyus	0.2	<1
Senna glutinosa subsp. *glutinosa*	0.6	<1
Senna glutinosa subsp. *pruinosa*	0.3	<1
Senna symonii	0.3	<1
Triodia epactia	0.2	25

MC20Q08

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200099 **mE** 7601154 **mN** **Lat.** -21.6677 **Long.** 120.1022

Habitat Mid-Slope

Aspect E **Slope** Moderate

Soil Type Brown clayey loam

Rock Type Ironstone

Loose Rock 50-90 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 55 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\bi;M ^*Acacia inaequilatera*\^shrub\4\bi;G ^*Triodia epactia*,^*Indigofera monophylla*\^hummock grass,shrub\1\i

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.3	<1	
Acacia inaequilatera		2.3	<1	
Bonamia pilbarensis		0.2	<1	
Bulbostylis barbata		0.1	<1	
Corchorus parviflorus		0.4	<1	

Corymbia hamersleyana	3	<1
Eucalyptus leucophloia subsp. *leucophloia*	6	1
Evolvulus alsinoides var. *villosicalyx*	0.1	<1
Fimbristylis dichotoma	0.15	<1
Goodenia cusackiana	.3	<1
Goodenia stobbsiana	0.1	<1
Heliotropium tenuifolium	0.2	<1
Hibiscus coatesii	0.2	<1
Hibiscus sturtii var. *campylochlamys*	0.2	<1
Indigofera monophylla	0.4	0.8
Ptilotus exaltatus	0.2	<1
Senna glutinosa subsp. *glutinosa*	1	<1
Senna symonii	0.5	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.15	<1
Sporobolus australasicus	0.2	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	<1
Tribulus suberosus	0.2	<1
Trigastrotheca molluginea	0.15	<1
Triodia epactia	.5	26

MC20Q09

Staff JLT **Date** 13/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199405 **mE** 7604392 **mN** **Lat.** -21.6383 **Long.** 120.0961

Habitat Flat

Aspect SE **Slope** Very Gentle

Soil Type Orange clay sand

Rock Type Basalt

Loose Rock 50-90 % cover; 6-20 mm in size **Litter** 1 % cover ; 0 cm in depth

Bare ground 70 % cover **Weeds** 0 % cover

Vegetation 6biM+ ^*Acacia inaequilatera*\^shrub\\;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	<1	
Acacia inaequilatera		5	0.5	
Alysicarpus muelleri		0.1	<1	
Aristida contorta		0.2	<1	
Bulbostylis barbata		0.1	<1	

Corchorus parviflorus	0.3	<1
Eremophila forrestii	0.2	<1
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Fimbristylis dichotoma	0.2	<1
Gossypium australe	0.4	<1
Indigofera monophylla	0.5	<1
Senna glutinosa subsp. *glutinosa*	1.5	<1
Sida echinocarpa	0.3	<1
Sporobolus australasicus	0.1	<1
Tribulus suberosus	0.6	<1
Triodia epactia	0.3	28

MC20Q10

Staff JLT **Date** 10/04/2020 **Season** E

Revisit

Type Q 100 m x 25 m

Location

MGA Zone 51 204612 **mE** 7608077 **mN** **Lat.** -21.6060 **Long.** 120.1470

Habitat Creek

Aspect SE **Slope** Very Gentle

Soil Type Sandy clay

Rock Type Ironstone

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** 5 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 10 % cover

Vegetation U+ ^*Eucalyptus victrix*\^tree\6\i;M ^*Acacia coriacea*,^*Acacia bivenosa*\^shrub\4\i;G ^*Cenchrus ciliaris*\^tussock grass\1\r

Veg. Condition Poor

Disturbance Cattle, nearby trough

Fire Age >10 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		1.5	<1	
Acacia acradenia		2	<1	
Acacia bivenosa		3	3	
Acacia coriacea		5	12	
Acacia pyrifolia var. *pyrifolia*		1	<1	

Acacia tumida var. *pilbarensis*	1w	<1
Alternanthera nana	0.2	<1
Alternanthera nana	.2	<1
Androcalva luteiflora	0.5	<1
Atalaya hemiglauca	1.5	0.5
Boerhavia burbidgeana	0.05	<1
**Cenchrus ciliaris*	.1	8
Chrysopogon fallax	0.9	<1
Cleome viscosa	0.4	<1
Corymbia ferriticola	10	<1
Crotalaria medicaginea var. *neglecta*	5	<1
**Cynodon dactylon*	.25	<1
Cyperus bifax	0.4	<1
Dichanthium sericeum	0.4	<1
**Echinochloa colona*	0.3	<1
Eragrostis cumingii	0.3	<1
Eremophila longifolia	1	<1
Eriachne mucronata	.2	<1
Eucalyptus victrix	12	15
Euphorbia australis var. *hispidula*	.03	<1
Euphorbia biconvexa	0.1	<1
Evolvulus alsinoides var. *villosicalyx*	.05	<1
Gossypium australe	.3	<1
Gossypium robinsonii	0.3	<1
Hakea chordophylla	2	<1
Hybanthus aurantiacus	.15	<1
Indigofera linnaei	0.05	<1
Indigofera monophylla	0.5	<1
Melhania oblongifolia	.2	<1
Paraneurachne muelleri	0.2	<1
Phyllanthus maderaspatensis	0.3	<1
Phyllanthus maderaspatensis	.4	<1
Pluchea dentex	0.1	<1
Polymeria ambigua	.05	<1
Portulaca oleracea	0.2	<1
Pterocaulon sphacelatum	0.1	<1
Schizachyrium fragile	.2	<1
Solanum diversiflorum	.2	<1

Solanum diversiflorum	.2	<1
Sporobolus australasicus	0.1	<1
Themeda triandra	0.2	<1
Triodia longiceps	.4	<1
Triumfetta clementii	0.2	<1

MC20Q11

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199790 **mE** 7600863 **mN** **Lat.** -21.6702 **Long.** 120.0991

Habitat Minor creek

Aspect N **Slope** Very Gentle

Soil Type Brown sandy clay

Rock Type Ironstone

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 40 % cover **Weeds** <1 % cover

Vegetation U+ ^*Corymbia hamersleyana*,^*Eucalyptus victrix*\^tree mallee,tree\6\bi;M ^^*Petalostylis labicheoides*,*Acacia pyrifolia* var. *morrisonii*,*Acacia trachycarpa*\^shrub\4\i;G ^^*Themeda triandra*, *Triodia epactia*,*Cenchrus ciliaris*\^tussock grass,hummock grass\1\r

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		.3	<1	
Acacia bivenosa		.8	<1	
Acacia colei var. *colei*		1.5	<1	
Acacia pyrifolia var. *morrisonii*		2.5	3	

Acacia trachycarpa	.8	1
Acacia tumida var. *pilbarensis*	1.8	1.5
**Aerva javanica*	.3	<1
Boerhavia coccinea	.15	<1
**Cenchrus ciliaris*	.4	<1
**Cenchrus setiger*	.4	<1
Chrysopogon fallax	.45	<1
Clerodendrum floribundum	.15	<1
Corchorus crozophorifolius	.45	<1
Corchorus parviflorus	0.3	<1
Corymbia hamersleyana	6	2.5
Cymbopogon ambiguus	.4	<1
Dampiera candicans	0.3	<1
Enneapogon lindleyanus	.4	<1
Eriachne mucronata	.3	<1
Eucalyptus victrix	4	1
Evolvulus alsinoides var. *decumbens*	.2	<1
Goodenia muelleriana	.15	<1
Goodenia stobbsiana	.15	<1
Gossypium australe	.45	<1
Grevillea wickhamii	1	<1
Hybanthus aurantiacus	.2	<1
Indigofera monophylla	.3	<1
Paraneurachne muelleri	.3	<1
Petalostylis labicheoides	1.5	8
Polymeria ambigua	0.15	<1
Pterocaulon serrulatum	.3	<1
Rhynchosia minima	.3	<1
Salsola australis	.3	<1
Senna glutinosa subsp. *glutinosa*	1.5	<1
Sesbania cannabina	.4	<1
Sida fibulifera	.3	<1
Sporobolus australasicus	.15	<1
Stemodia grossa	.2	<1
Tephrosia rosea var. *clementii*	.3	<1
Themeda triandra	.35	2.5
Triodia epactia	.3	2
Triodia longiceps	.35	<1

MC20Q12

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 100 m x 25 m

Location

MGA Zone 51 198936 **mE** 7600072 **mN** **Lat.** -21.6772 **Long.** 120.0908

Habitat Creek

Aspect E **Slope** Very Gentle

Soil Type Brown sand/rocks

Rock Type Various

Loose Rock <2 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 70 % cover **Weeds** 4 % cover

Vegetation U+ ^*Eucalyptus victrix*\^tree\6\bi;M ^*Acacia trachycarpa*\^shrub\4\bi;G ^^*Cenchrus ciliaris*, *Cenchrus setiger*,*Triodia longiceps*\^tussock grass,hummock grass\2\r

Veg. Condition Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia ?adsurgens		1.5	<1	
Acacia coriacea subsp. *pendens*		1.5	0.5	
Acacia inaequilatera		0.5	<1	
Acacia pyrifolia var. *pyrifolia*		0.9	<1	
Acacia trachycarpa		1.3	1	

Acacia tumida var. *pilbarensis*	0.3	<1
Alternanthera nana	0.2	<1
Aristida holathera	0.3	<1
Atalaya hemiglauca	1	0.5
Boerhavia gardneri	0.2	<1
**Cenchrus ciliaris*	0.7	15
**Cenchrus setiger*	0.4	3
Chrysopogon fallax	0.4	<1
Cleome viscosa	0.2	<1
Corchorus parviflorus	0.2	<1
Corymbia candida subsp. *dipsodes*	0.7	<1
Cucumis variabilis	0.2	<1
Cyperus ixiocarpus	0.4	<1
Eragrostis cumingii	0.3	<1
Eragrostis eriopoda	0.2	<1
Eriachne benthamii	0.4	<1
Eriachne mucronata	0.2	<1
Eucalyptus victrix	2	8
Eulalia aurea	0.6	<1
Euphorbia sp.	0.2	<1
Evolvulus alsinoides var. *decumbens*	0.2	<1
Evolvulus alsinoides var. *villosicalyx*	0.15	<1
Fimbristylis microcarya	0.1	<1
Goodenia microptera	0.2	<1
Gossypium australe	0.4	<1
Gossypium robinsonii	0.5	<1
Heteropogon contortus	0.3	<1
Indigofera monophylla	0.6	<1
Indigofera sp.	0.1	<1
Melaleuca glomerata	1	<1
Melhania oblongifolia	0.2	<1
Paraneurachne muelleri	0.2	<1
Pluchea dentex	0.6	<1
Polymeria ambigua	0.15	<1
Polymeria ambigua	0.2	<1
Polymeria ambigua	0.1	<1
Rhynchosia minima	0.3	<1
Schizachyrium fragile	0.1	<1

Sesbania cannabina	0.2	<1
Sida echinocarpa	0.2	<1
Sida echinocarpa	0.4	<1
Stemodia grossa	0.1	<1
Tephrosia clementii	0.2	<1
Tephrosia rosea var. *clementii*	0.2	<1
Themeda triandra	0.4	<1
Trigastrotheca molluginea	0.2	<1
Triodia longiceps	0.6	3

MC20Q13

Staff JLT **Date** 10/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 203587 **mE** 7608409 **mN** **Lat.** -21.6028 **Long.** 120.1371

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Brown sandy loam

Rock Type Ironstone

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia inaequilatera*,^*Scaevola spinescens*\^shrub\4\bi;G ^*Triodia longiceps*,^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Very Good

Disturbance

Fire Age 2-5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia inaequilatera		2.5	1.8	
Acacia pyrifolia var. *pyrifolia*		.5	<1	
Acacia synchronicia		1.3	<1	
Atalaya hemiglauca		.8	<1	
Boerhavia burbidgeana		.15	<1	

Bulbostylis barbata	.05	<1
**Cenchrus ciliaris*	.3	<1
Chrysopogon fallax	.4	<1
Cleome viscosa	.2	<1
Corchorus lasiocarpus	.4	<1
Evolvulus alsinoides var. *villosicalyx*	.15	<1
Goodenia microptera	0.1	<1
Gossypium australe	.4	<1
Hibiscus sturtii var. *platychlamys*	.4	<1
Indigofera monophylla	.45	<1
Paraneurachne muelleri	.35	<1
Polycarpaea longiflora	.15	<1
Portulaca oleracea	.05	<1
Ptilotus astrolasius	35	<1
Rhagodia eremaea	.15	<1
Scaevola spinescens	1.2	1
Senna artemisioides subsp. *oligophylla*	.2	<1
Senna glutinosa subsp. *glutinosa* x *luerssenii*	1	<1
Sida echinocarpa	.3	<1
Sida fibulifera	.2	<1
Sporobolus australasicus	.1	<1
Tribulus hirsutus	.2	<1
Trigastrotheca molluginea	.2	<1
Triodia brizoides	0.4	<1
Triodia epactia	.4	5
Triodia longiceps	.45	8
Triumfetta clementii	.45	<1

MC20Q14

Staff JLT **Date** 13/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 200332 **mE** 7603663 **mN** **Lat.** -21.6451 **Long.** 120.1049

Habitat Minor hill

Aspect S **Slope** Gentle

Soil Type Orange brown sandy clay

Rock Type Ironstone

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** 1 % cover ; 0 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia orthocarpa*,^*Acacia inaequilatera*\^shrub\4\r;G ^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia ancistrocarpa		2	<1	
Acacia bivenosa		1.5	<1	
Acacia inaequilatera		3	1.5	
Acacia orthocarpa		3	2	
Boerhavia gardneri		0.3	<1	

Bulbostylis barbata	0.1	<1
Corchorus parviflorus	0.6	<1
Cucumis variabilis	0.2	<1
Euphorbia careyi	0.2	<1
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Grevillea pyramidalis	2	<1
Grevillea wickhamii	2	<1
Hakea chordophylla	0.4	<1
Indigofera monophylla	1	<1
Solanum phlomoides	0.2	<1
Trigastrotheca molluginea	0.15	<1
Triodia epactia	0.5	30
Triumfetta clementii	0.2	<1

MC20Q15

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 198696 **mE** 7600186 **mN** **Lat.** -21.6762 **Long.** 120.0885

Habitat Minor hill

Aspect S **Slope** Gentle

Soil Type Orange brown clay loam

Rock Type Ironstone

Loose Rock 10-20 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia inaequilatera*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.2	<1	
Acacia inaequilatera		2.8	2	
Acacia ptychophylla		0.3	<1	
Acacia pyrifolia		0.4	<1	
Bonamia pilbarensis		0.2	<1	

Bulbostylis barbata	0.1	<1
Corchorus parviflorus	0.4	<1
Corymbia hamersleyana	0.6	<1
Cymbopogon ambiguus	0.3	<1
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Fimbristylis dichotoma	0.2	<1
Goodenia stobbsiana	0.1	<1
Gossypium australe	0.3	<1
Heliotropium inexplicitum	0.2	<1
Hibiscus coatesii	0.2	<1
Hibiscus sturtii var. *campylochlamys*	0.2	<1
Indigofera monophylla	0.6	<1
Paraneurachne muelleri	0.1	<1
Perotis rara	0.1	<1
Polycarpaea holtzei	0.1	<1
Polycarpaea longiflora	0.2	<1
Ptilotus calostachyus	0.3	<1
Senna glutinosa subsp. *glutinosa*	0.7	<1
Senna glutinosa subsp. *pruinosa*	0.7	<1
Senna glutinosa subsp. x *luerssenii*	0.7	<1
Sida echinocarpa	0.3	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.2	<1
Sporobolus australasicus	0.15	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.2	<1
Trigastrotheca molluginea	0.2	<1
Triodia epactia	.4	26

MC20Q16

Staff JLT **Date** 11/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 203289 **mE** 7606926 **mN** **Lat.** -21.6161 **Long.** 120.1340

Habitat Flat

Aspect SW **Slope** Very Gentle

Soil Type Sandy clay

Rock Type Ironstone

Loose Rock 20-50 % cover; 2-6 mm in size **Litter** 2 % cover ; <1 cm in depth

Bare ground 50 % cover **Weeds** <1 % cover

Vegetation U+ ^*Corymbia hamersleyana*\^tree\6\bi;M ^^*Acacia inaequilatera*,*Acacia bivenosa*,*Hakea chordophylla*\^shrub\4\bi;G ^^*Triodia epactia*,*Themeda triandra*\^hummock grass,tussock grass\2\c

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.8	1.5	
Acacia inaequilatera		3	3	
Acacia orthocarpa		1.2	<1	
Aristida contorta		0.2	<1	

Boerhavia coccinea	0.1	<1
Bonamia pilbarensis	0.1	<1
Bulbostylis barbata	0.1	<1
**Cenchrus ciliaris*	0.1	<1
Chrysopogon fallax	0.1	<1
Cleome viscosa	0.1	<1
Corchorus crozophorifolius	0.1	<1
Corymbia hamersleyana	5	1
Crotalaria medicaginea var. *neglecta*	0.1	<1
Cucumis variabilis	0.2	<1
Dactyloctenium radulans	0.1	<1
Enneapogon polyphyllus	0.1	<1
Eriachne pulchella subsp. *dominii*	0.1	<1
Euphorbia australis var. *hispidula*	0.05	<1
Evolvulus alsinoides var. *decumbens*	0.1	<1
Fimbristylis dichotoma	0.2	<1
Goodenia microptera	0.1	<1
Goodenia muelleriana	0.1	<1
Gossypium australe	0.6	<1
Hakea chordophylla	4	1
Heliotropium cunninghamii	0.1	<1
Hibiscus sturtii var. *campylochlamys*	0.1	<1
Indigofera colutea	0.1	<1
Indigofera monophylla	0.4	<1
Iseilema vaginiflorum	0.1	<1
**Malvastrum americanum*	0.2	<1
Paspalidium rarum	0.1	<1
Perotis rara	0.1	<1
Portulaca oleracea	0.1	<1
Ptilotus aervoides	0.05	<1
Rhynchosia minima	0.1	<1
Scaevola spinescens	1	<1
Senna artemisioides subsp. *oligophylla*	0.2	<1
Senna glutinosa subsp. *glutinosa* x *luerssenii*	2	<1
Sida echinocarpa	0.2	<1
Sporobolus australasicus	0.1	<1
Stemodia grossa	0.05	<1
Tephrosia rosea var. *clementii*	0.1	<1

Themeda triandra	0.3	2
Tragus australianus	0.1	<1
Trigastrotheca molluginea	0.1	<1
Triodia epactia	0.5	30
Triodia longiceps	0.6	4
Triumfetta clementii	0.3	<1

MC20Q17

Staff JLT **Date** 10/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 205148 **mE** 7608607 **mN** **Lat.** -21.6013 **Long.** 120.1522

Habitat Flat

Aspect SE **Slope** Very Gentle

Soil Type Brown clay loam

Rock Type Ironstone

Loose Rock 20-50 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 40 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia inaequilatera*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia inaequilatera		2.2	2	
Aristida contorta		.2	<1	
Boerhavia coccinea		0.1	<1	
Bonamia pilbarensis		.1	<1	
Bulbostylis barbata		.2	<1	

Chrysopogon fallax	.6	<1
Cleome viscosa	.15	<1
Corchorus lasiocarpus	.5	<1
Enneapogon caerulescens	.06	<1
Enneapogon polyphyllus	.45	<1
Euphorbia australis var. *hispidula*	.05	<1
Evolvulus alsinoides var. *villosicalyx*	0.05	<1
Fimbristylis dichotoma	.15	<1
Goodenia muelleriana	.3	<1
Gossypium australe	.1.2	<1
Iseilema vaginiflorum	.05	<1
Paspalidium rarum	.15	<1
Perotis rara	.05	<1
Polycarpaea longiflora	.15	<1
Portulaca oleracea	.05	<1
Rhynchosia minima	.2	<1
Senna glutinosa subsp. *pruinosa*	.45	<1
Sida echinocarpa	.45	<1
Sporobolus australasicus	.1	<1
Tephrosia sp.	.1	<1
Tragus australianus	.08	<1
Triodia epactia	.35	55
Yakirra australiensis var. *australiensis*	.15	<1

MC20Q18

Staff JLT **Date** 11/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 201992 **mE** 7604812 **mN** **Lat.** -21.6350 **Long.** 120.1211

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Sandy clay

Rock Type Ironstone

Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Acacia orthocarpa*,*Acacia bivenosa*,*Acacia inaequilatera*\^shrub\4\r;G ^*Triodia epactia*\^hummock grass\2\c

Veg. Condition Very Good

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		1	<1	
Acacia bivenosa		1	2	
Acacia inaequilatera		5	1.5	
Acacia orthocarpa		2	2.5	
Acacia pyrifolia var. *pyrifolia*		1.5	<1	

Bonamia pilbarensis	0.2	<1
Bulbostylis barbata	0.1	<1
Corchorus parviflorus	0.6	<1
Dampiera candicans	0.4	<1
Eriachne pulchella subsp. *dominii*	0.1	<1
Evolvulus alsinoides var. *villosicalyx*	0.2	<1
Fimbristylis simulans	0.1	<1
Goodenia cusackiana	0.1	<1
Goodenia muelleriana	0.1	<1
Goodenia stobbsiana	0.2	<1
Gossypium australe	0.8	<1
Grevillea wickhamii	0.9	<1
Heliotropium cunninghamii	0.1	<1
Indigofera monophylla	0.7	<1
Ptilotus calostachyus	0.3	<1
Senna artemisioides subsp. *helmsii*	0.5	<1
Senna glutinosa subsp. *pruinosa*	0.5	<1
Senna glutinosa subsp. x *luerssenii*	0.5	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	<1
Trigastrotheca molluginea	0.1	<1
Triodia epactia	0.4	20

MC20Q19

Staff JLT **Date** 16/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 199556 **mE** 7600336 **mN** **Lat.** -21.6750 **Long.** 120.0968

Habitat Flat

Aspect SE **Slope** Very Gentle

Soil Type Orange sandy clay loam

Rock Type Ironstone

Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia inaequilatera*\^shrub\4\bi;G ^*Triodia epactia*\^hummock grass\1\i

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia aphanoclada x *pyrifolia* var. *pyrifolia*		0.3	<1	
Acacia inaequilatera		3	1.5	
Aristida contorta		0.2	<1	
Bulbostylis barbata		0.1	<1	
Cleome viscosa		0.1	<1	

Corchorus parviflorus	0.4	<1
Eriachne pulchella subsp. *dominii*	0.15	<1
Evolvulus alsinoides var. *villosicalyx*	0.1	<1
Gomphrena cunninghamii	0.1	<1
Goodenia muelleriana	0.3	<1
Goodenia stobbsiana	0.4	<1
Gossypium australe	0.5	<1
Grevillea wickhamii	0.3	<1
Heliotropium tenuifolium	0.2	<1
Hibiscus sturtii var. *campylochlamys*	0.3	<1
Polymeria ambigua	0.2	<1
Ptilotus calostachyus	0.5	<1
Ptilotus exaltatus	0.1	<1
Senna glutinosa subsp. *glutinosa*	0.5	<1
Senna glutinosa subsp. *pruinosa*	0.3	<1
Senna glutinosa subsp. x *luerssenii*	0.2	<1
Senna symonii	0.3	<1
Sida echinocarpa	0.4	<1
Sporobolus australasicus	0.1	<1
Trigastrotheca molluginea	0.2	<1
Triodia epactia	0.4	25
Triodia wiseana	0.3	<1

MC20Q20

Staff JLT **Date** 17/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197870 **mE** 7599961 **mN** **Lat.** -21.6781 **Long.** 120.0804

Habitat Minor hill

Aspect E **Slope** Gentle

Soil Type Brown clayey loam

Rock Type Ironstone

Loose Rock 10-20 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 55 % cover **Weeds** <1 % cover

Vegetation M+ ^*Acacia inaequilatera*\^shrub\4\r;G ^*Triodia epactia*,^*Triodia wiseana*\^hummock grass\1\i

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		.8	<1	
Acacia inaequilatera		2.8	3	
Acacia ptychophylla		.35	<1	
Corchorus parviflorus		1	<1	
Corymbia hamersleyana		4	<1	

Evolvulus alsinoides var. *villosicalyx*	.1	<1
Indigofera monophylla	.3	<1
Senna glutinosa subsp. *glutinosa* x *luerssenii*	1.3	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	.05	<1
Triodia epactia	.45	23
Triodia wiseana	.4	2

MC20Q21

Staff JLT **Date** 17/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 197305 **mE** 7599861 **mN** **Lat.** -21.6789 **Long.** 120.0750

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Coarse orange sand

Rock Type Ironstone

Loose Rock <2 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 65 % cover **Weeds** 0 % cover

Vegetation M ^*Acacia* sp.,^*Acacia trachycarpa*\^shrub\4\r;G+ ^*Triodia epactia*\^hummock grass\2\i

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.3	<1	
Acacia sp.		2	3	
Acacia trachycarpa		1	7	
Aristida contorta		0.2	<1	
Bonamia erecta		0.2	<1	

Bulbostylis barbata	0.1	<1
**Cenchrus ciliaris*	0.2	<1
Chrysopogon fallax	0.2	<1
**Cynodon dactylon*	0.1	<1
Eragrostis cumingii	0.2	<1
Eragrostis eriopoda	0.3	<1
Eriachne pulchella subsp. *dominii*	0.15	<1
Evolvulus alsinoides var. *decumbens*	0.1	<1
Fimbristylis dichotoma	0.2	<1
Fimbristylis microcarya	0.1	<1
Goodenia microptera	0.2	<1
Heliotropium chrysocarpum	0.2	<1
Hibiscus sturtii var. *campylochlamys*	0.2	<1
Hybanthus aurantiacus	0.2	<1
Indigofera monophylla	0.4	<1
Paraneurachne muelleri	0.1	<1
Pluchea dentex	0.2	<1
Polycarpaea longiflora	0.15	<1
Polymeria ambigua	0.2	<1
Schizachyrium fragile	0.2	<1
Senna notabilis	0.2	<1
Sporobolus australasicus	0.1	<1
Triodia epactia	0.6	15
Yakirra australiensis var. *australiensis*	0.15	<1

MC20Q22

Staff JLT **Date** 12/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 196128 **mE** 7607910 **mN** **Lat.** -21.6060 **Long.** 120.0651

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Clay

Rock Type Ironstone

Loose Rock <2 % cover; 2-6 mm in size **Litter** 2 % cover ; 0 cm in depth

Bare ground 30 % cover **Weeds** 1 % cover

Vegetation M ^^*Acacia trachycarpa*,*Acacia pyrifolia* var. *pyrifolia*,*Acacia bivenosa*\^shrub\4\r;G+ ^*Triodia longiceps*\^hummock grass\2\c

Veg. Condition Excellent

Disturbance

Fire Age >10 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	2	
Acacia pyrifolia var. *pyrifolia*		1.2	0.5	
Acacia trachycarpa		1.2	5	
Alternanthera nodiflora		0.4	<1	
Alysicarpus muelleri		0.2	<1	

Bulbostylis turbinata	0.1	<1
**Cenchrus ciliaris*	0.2	<1
**Cenchrus setiger*	0.7	2
Chloris pumilio	0.1	<1
Chrysopogon fallax	0.2	<1
Corchorus tridens	0.2	<1
Cyperus squarrosus	0.1	<1
Eragrostis cumingii	0.1	<1
Eragrostis leptocarpa	0.3	<1
Euphorbia sp.	0.2	<1
Fimbristylis dichotoma	0.4	<1
Hakea chordophylla	2	<1
Indigofera colutea	0.2	<1
Indigofera linifolia	0.2	<1
Indigofera linnaei	0.2	<1
Iseilema vaginiflorum	0.2	<1
Pluchea dentex	0.3	<1
Pluchea ferdinandi-muelleri	0.6	<1
Pluchea rubelliflora	0.1	<1
Rhynchosia minima	0.2	<1
Senna artemisioides subsp. *helmsii*	0.3	<1
Sida fibulifera	0.3	<1
Sporobolus australasicus	0.2	<1
Stemodia grossa	0.3	<1
Themeda triandra	0.3	<1
Triodia longiceps	0.5	60

MC20Q23

Staff JLT **Date** 12/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 196071 **mE** 7606345 **mN** **Lat.** -21.6202 **Long.** 120.0642

Habitat Creek

Aspect N/A **Slope** N/A

Soil Type Orange clayey sand

Rock Type Ironstone

Loose Rock 2-10 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 40 % cover **Weeds** <1 % cover

Vegetation M+ ^*Acacia bivenosa*,^*Acacia trachycarpa*\^shrub\4\r;G ^*Triodia longiceps*,^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		2	5	
Acacia inaequilatera		1.2	<1	
Acacia trachycarpa		1.8	8	
Alysicarpus muelleri		.15	<1	
Cassytha capillaris		0.1	<1	

**Cenchrus ciliaris*	.1	<1
**Cenchrus setiger*	.2	<1
Corchorus lasiocarpus	.4	<1
Corchorus parviflorus	.5	<1
Cucumis variabilis	.q	<1
Dodonaea coriacea	.2	<1
Euphorbia sp.	.15	<1
Fimbristylis dichotoma	.25	<1
Goodenia microptera	.15	<1
Grevillea pyramidalis subsp. *leucadendron*	1.2	<1
Indigofera monophylla	.8	<1
Paraneurachne muelleri	.2	<1
Pluchea ferdinandi-muelleri	.24	<1
Polymeria ambigua	.1	<1
Portulaca sp.	.05	<1
Rhynchosia minima	.2	<1
Senna artemisioides subsp. *helmsii*	1.6	<1
Senna artemisioides subsp. *oligophylla*	.8	<1
Senna glutinosa subsp. *glutinosa*	1.5	<1
Senna glutinosa subsp. x *luerssenii*	1	<1
Senna symonii	1	<1
Sida echinocarpa	.5	<1
Solanum phlomoides	0.4	<1
Sporobolus australasicus	.15	<1
Stemodia grossa	.4	<1
Triodia epactia	.3	8
Triodia longiceps	.4	45

MC20Q24

Staff JLT **Date** 18/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 202985 **mE** 7609989 **mN** **Lat.** -21.5884 **Long.** 120.1316

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Brown clay loam

Rock Type Ironstone / BIF

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 30 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia monticola*,^*Hakea lorea* subsp. *lorea*\^shrub\4\c;G ^*Triodia epactia*,^*Eriachne lanata*\^hummock grass,tussock grass\1\c

Veg. Condition Very Good

Disturbance

Fire Age >5 years

Notes Disturbed by old drill pads

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		1.3	<1	
Acacia bivenosa		.2	<1	
Acacia monticola		2.4	22	
Corchorus parviflorus		.35	<1	
Dampiera candicans		.4	<1	

Eriachne lanata	.3	65
Evolvulus alsinoides var. *villosicalyx*	.1	<1
Goodenia stobbsiana	.2	0.2
Grevillea wickhamii	1.8	0.2
Hakea lorea subsp. *lorea*	3	1
Hibiscus coatesii	.4	<1
Indigofera monophylla	.4	<1
Ptilotus calostachyus	.4	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	.3	<1
Triodia epactia	.4	8
Triumfetta maconochieana	.4	<1

MC20Q25

Staff JLT **Date** 12/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 195876 **mE** 7607806 **mN** **Lat.** -21.6069 **Long.** 120.0626

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Black haemotite over pale brown silt

Rock Type Haemotite

Loose Rock 10-20 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 50 % cover **Weeds** 0 % cover

Vegetation U ^*Corymbia hamersleyana*\^tree\6\bi;M ^*Acacia inaequilatera*\^shrub\4\bi;G+ ^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.3	<1	
Acacia eriopoda		1	<1	
Acacia inaequilatera		3	1	
Acacia monticola x trachycarpa		.8	<1	
Acacia orthocarpa		2.5	<1	

Acacia pyrifolia var. *pyrifolia*	1	<1
Alysicarpus muelleri	.2	<1
Aristida hygrometrica	.2	<1
Bonamia pilbarensis	.05	<1
Bulbostylis barbata	.1	<1
Corchorus parviflorus	.4	<1
Corymbia hamersleyana	6	1
Eriachne pulchella subsp. *dominii*	.05	<1
Fimbristylis dichotoma	.2	<1
Goodenia microptera	.10	<1
Goodenia triodiophila	.3	<1
Gossypium australe	.3	<1
Indigofera linifolia	.1	<1
Rhynchosia minima	.15	<1
Senna glutinosa subsp. *glutinosa*	1	<1
Senna symonii	1	<1
Triodia epactia	.4	35
Triodia longiceps	.3	<1

MC20Q26

Staff JLT **Date** 14/04/2020 **Season** E

Revisit

Type Q 50 m x 50 m

Location

MGA Zone 51 204122 **mE** 7612540 **mN** **Lat.** -21.5656 **Long.** 120.1430

Habitat Crest

Aspect W **Slope** Moderate

Soil Type Brown/orange Clay sand

Rock Type Quartz/ironstone

Loose Rock >90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 70 % cover **Weeds** 0 % cover

Vegetation U+ ^*Eucalyptus leucophloia* subsp. *leucophloia*\^tree\6\r;M ^*Acacia ptychophylla*\^shrub\4\bi;G ^^*Triodia epactia*,*Triodia brizoides*,*Eriachne mucronata*\^hummock grass,tussock grass\1\c

Veg. Condition Excellent

Disturbance

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.4	<1	
Acacia inaequilatera		2	<1	
Acacia ptychophylla		0.6	3	
Acacia pyrifolia var. *pyrifolia*		0.8	<1	
Corchorus parviflorus		0.3	<1	

Cymbopogon ambiguus	0.6	<1
Enneapogon lindleyanus	0.2	<1
Eriachne mucronata	0.3	<1
Eriachne mucronata	0.5	3
Eucalyptus leucophloia subsp. *leucophloia*	6	4
Evolvulus alsinoides var. *decumbens*	0.2	<1
Evolvulus alsinoides var. *villosicalyx*	0.1	<1
Fimbristylis dichotoma	0.3	<1
Gossypium australe	0.4	<1
Grevillea wickhamii	0.2	<1
Hakea chordophylla	0.5	<1
Hibiscus sturtii var. *campylochlamys*	0.2	<1
Hybanthus aurantiacus	0.2	<1
Indigofera monophylla	0.5	<1
Ptilotus calostachyus	0.5	<1
Rhynchosia minima	0.2	<1
Scaevola spinescens	0.2	<1
Senna glutinosa subsp. *glutinosa*	0.8	<1
Senna glutinosa subsp. x *luerssenii*	0.5	<1
Senna symonii	0.6	<1
Senna symonii	0.2	<1
Sida echinocarpa	0.3	<1
Sida fibulifera	0.2	<1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	<1
Tribulus suberosus	0.2	<1
Trigastrotheca molluginea	0.1	<1
Triodia brizoides	0.3	17
Triodia epactia	0.3	30

MC20Q27

Staff JLT **Date** 15/04/2020 **Season** E

Revisit

Type Q 100 m x 25 m

Location

MGA Zone 51 201267 **mE** 7603134 **mN** **Lat.** -21.6500 **Long.** 120.1138

Habitat Creek

Aspect N/A **Slope** N/A

Soil Type Brown sandy clay

Rock Type Ironstone

Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <1 cm in depth

Bare ground 30 % cover **Weeds** 20 % cover

Vegetation U+ ^*Eucalyptus victrix*\^tree\7\i;M ^^*Acacia trachycarpa*,*Melaleuca glomerata*\^shrub\4\r;G ^*Cenchrus ciliaris*,^*Cenchrus setiger*\^tussock grass\1\i

Veg. Condition Degraded

Disturbance

Fire Age 5 - 10 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia acradenia		1.2	<1	
Acacia adsurgens		.8	<1	
Acacia coriacea		1	0.5	
Acacia coriacea subsp. *pendens*		2	<1	
Acacia pyrifolia var. *pyrifolia*		1.5	<1	

Acacia trachycarpa	2.5	1.5
Atalaya hemiglauca	2	2
Boerhavia coccinea	.15	<1
**Cenchrus ciliaris*	.3	20
**Cenchrus setiger*	0.4	1
Cleome viscosa	0.25	<1
Corchorus crozophorifolius	.4	<1
Corchorus parviflorus	1.2	<1
Cymbopogon ambiguus	.5	<1
Cyperus bifax	.8	<1
Eriachne mucronata	.4	<1
Eucalyptus victrix	15	3
Euphorbia sp.	.15	<1
Gossypium australe	.7	<1
Hybanthus aurantiacus	.15	<1
Melaleuca glomerata	2	3
Phyllanthus maderaspatensis	.2	<1
Santalum lanceolatum	1.2	<1
Scaevola amblyanthera var. *centralis*	.15	<1
Scaevola spinescens	1	<1
Tephrosia rosea var. *clementii*	.3	<1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	.05	<1
Themeda triandra	.3	<1

APPENDIX FIVE DBCA REPORT FORMS

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Acacia aphanoclada **TPFL Pop. No:**

OBSERVATION DATE: 15/04/2020 **CONSERVATION STATUS:** P1 New population ☐

OBSERVER/S: James Tsakalos **PHONE:** 9430 8955

ROLE: Senior Environmental Scientist **ORGANISATION:** Ecoscape (Australia) Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

South of Atlas Iron McPhee Creek tenements

Approximately 24 km north of Nullagine, approximately 4 km east of Nullagine-Marble Bar Road

Coordinates below are representative **Reserve No:**

DBCA DISTRICT: Pilbara Region **LGA:** East Pilbara Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: 7602439.817
Long / Easting: 200440.832
ZONE: 51

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: ____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:
Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	2,000+			
Dead				

Area of pop (m²): _____
Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. ___ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☒
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☒

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☒
Brown ☒
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia low woodland
2. Acacia inaequilatera, A. bivenosa and Indigofera monophylla low isolated shrubland
3. Triodia epactia low hummock grassland
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: FB62000163 Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 15/07/2020

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

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TAXON: Rostellularia adscendens var. latifolia **TPFL Pop. No:**

OBSERVATION DATE: 10/04/2020 **CONSERVATION STATUS:** P3 New population ☒

OBSERVER/S: James Tsakalos **PHONE:** 9430 8955

ROLE: Senior Environmental Scientist **ORGANISATION:** Ecoscape (Australia) Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

South of Atlas Iron McPhee Creek tenements

Approximately 26 km north of Nullagine, approximately 4 km east of Nullagine-Marble Bar Road

Reserve No:

DBCA DISTRICT: Pilbara Region **LGA:** East Pilbara Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: 7608224.017
Long / Easting: 203879.67
ZONE: 51

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: ____ Map used: ____
Boundary polygon captured: ☐ Map scale: ____

LAND TENURE:
Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole ____ to ____ Specify other: ____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): ____
EFFORT: Time spent surveying (minutes): ____ No. of minutes spent / 100 m²: ____
POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: ____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	2			
Dead				

Area of pop (m²): ____
Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. ____ Size ____ Data attached ☐ Total area of quadrats (m²): ____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: ____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☒
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: silcrete

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☐
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Eucalyptus victrix and Corymbia hamersleyana mid open woodland
2. Acacia pyrifolia, Acacia trachycarpa and Acacia tumida var. pilbarensis tall shrubland
3. *Cenchrus ciliaris, Triodia longiceps and Cyperus vaginata low tussock grassland/hummock grassland/sedgeland
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☒ Degraded ☐ Completely degraded ☐

COMMENT: Growing on edge of stream

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: FB62000163 Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 15/07/2020

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Ptilotus mollis **TPFL Pop. No:**

OBSERVATION DATE: 18/04/2020 **CONSERVATION STATUS:** P4 New population ☐

OBSERVER/S: James Tsakalos **PHONE:** 9430 8955

ROLE: Senior Environmental Scientist **ORGANISATION:** Ecoscape (Australia) Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Atlas Iron McPhee Creek tenements

Approximately 32 km north of Nullagine, approximately 5 km east of Nullagine-Marble Bar Road

Reserve No:

DBCA DISTRICT: Pilbara Region **LGA:** East Pilbara Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: 7609884.968
Long / Easting: 202994.259
ZONE: 51

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: ____ Map used: ____
Boundary polygon captured: ☐ Map scale: ____

LAND TENURE:
Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole ____ to ____ Specify other: ____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): ____

EFFORT: Time spent surveying (minutes): ____ No. of minutes spent / 100 m²: ____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: ____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	4			
Dead				

Area of pop (m²): 25

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. ____ Size ____ Data attached ☐ Total area of quadrats (m²): ____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: ____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☐
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia low woodland
2. Acacia inaequilatera, A. bivenosa and Indigofera monophylla low isolated shrubland
3. Triodia epactia low hummock grassland
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: FB62000163 Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Lyn Atkins Role: Principal Ecologist Signed: _____ Date: 15/07/2020

Please return completed form to **Species And Communities Branch** DBCA,
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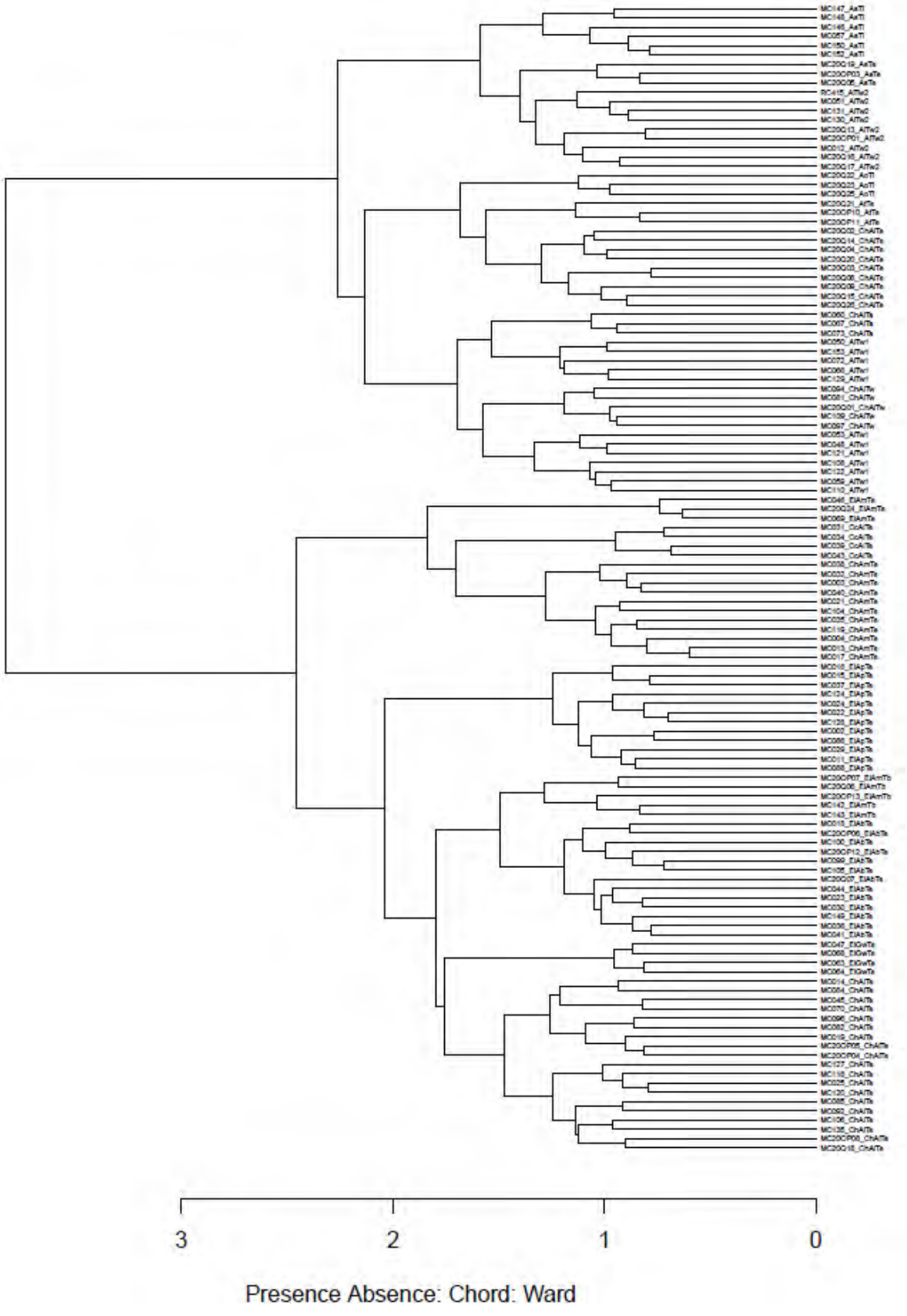
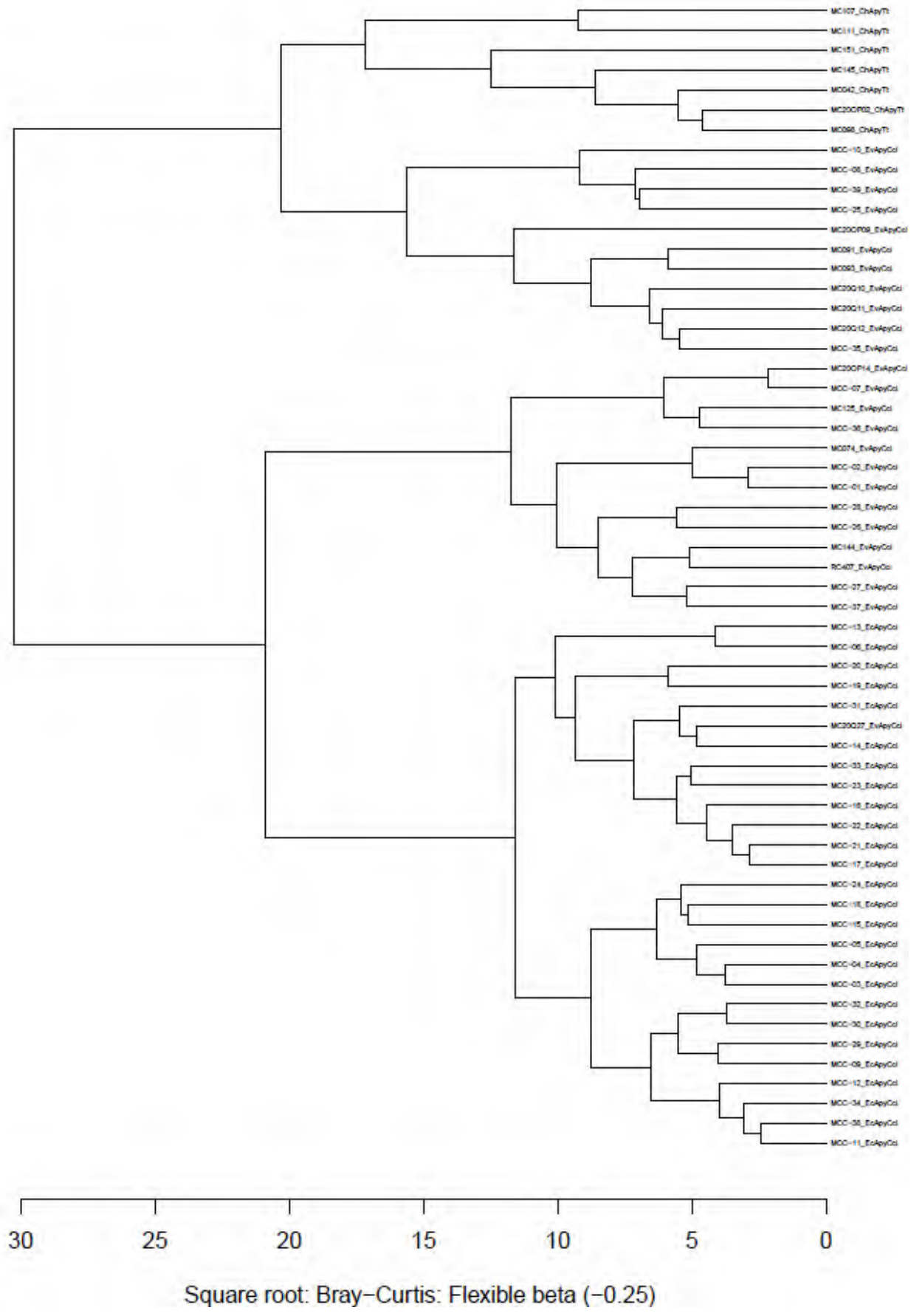
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

APPENDIX SIX FLORISTIC ANALYSIS DENDROGRAM




30
25
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APPENDIX SEVEN WOODMAN (2019A) MCPHEE CREEK REPORT

McPhee Creek Iron Ore Project

Detailed Flora and Vegetation Assessment

ATLAS IRON LTD

SEPTEMBER 2019

WOODMAN ENVIRONMENTAL

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McPhee Creek Detailed Flora and Vegetation Assessment

Prepared for: Atlas Iron Ltd

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Cover Photograph: Pool in creek near quadrat MCC03

DOCUMENT REVISION AND STATUS

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A	Draft Compiled Flora and Vegetation Assessment of McPhee Creek Compiled Study Area	LF	CG	26/7/2019	Monica Goggin	14/8/2019
0	Final Report	LF	CG	12/9/2019		

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DEFINITIONS

Term	Definition
ß	Beta
°C	Degrees Celsius
Þ	Significance
ALA	Atlas of Living Australia
AWC	Australian Weeds Committee
BC Act	*Biodiversity Conservation Act 2016* (State Act)
DBCA	Department of Biodiversity, Conservation and Attractions (State)
DEC	Department of Environment and Conservation (State; now DBCA)
DoEE	Department of the Environment and Energy (Commonwealth)
DPIRD	Department of Primary Industries and Regional Development (State)
DSO	Direct Shipping Ore
DWER	Department of Water and Environmental Regulation
e.g.	For example
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority (State)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESCAVI	Executive Steering Committee for Australian Vegetation Information
et al.	"and others"
GDA	Geocentric Datum of Australia
GDE	Groundwater Dependent Ecosystem
GDV	Groundwater Dependent Vegetation
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
indet.	indeterminate
INDVAL	A statistical method for analysing indicator species (indicator value)
km	Kilometres
m	Metres
mm	Millimetres
MNES	Matters of National Environmental Significance
P	Priority
PATN	Software package for statistical analysis
PC-Ord	Software package for multivariate statistical analysis of ecological communities
PEC	Priority Ecological Community
Pty Ltd	Proprietary Limited
ROM	Run of Mine
sp.	Species (singular)
SPRAT	Species Profile and Threats
T - DRF	Threatened (historically Declared Rare Flora at the State level)
TEC	Threatened Ecological Community
TP List	Threatened and Priority Flora List
TPFL	Threatened and Priority Flora (Database)

Term	Definition
UPGMA	Unweighted Pair Group Method with Arithmetic Mean
VT	Vegetation Type
WA	Western Australia
WA Herb.	Western Australian Herbarium
WC Act	*Wildlife Conservation Act 1950* (State; now superseded by BC Act)
WoNS	Weed of National Significance
Woodman Environmental	Woodman Environmental Consulting Pty Ltd

EXECUTIVE SUMMARY

Atlas Iron Limited (Atlas) is proposing to conduct mining activities at the McPhee Creek iron ore deposit, located in the Pilbara region of Western Australia. Various biological and heritage studies are required for referral under both State (Environmental Protection Act 1986 (EP Act) and Commonwealth (Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) levels. This report presents detailed flora and vegetation survey information for the McPhee Creek project area and associated riparian study area (Compiled Study Area), including compiling and updating information from one historical desktop and three baseline survey reports:

- Detailed Vegetation Survey for Vegetation (McPhee Creek project area): undertaken in May 2012;
- Targeted Survey for Significant Flora (McPhee Creek project area): undertaken in April 2013; and
- Detailed vegetation survey of riparian vegetation (Riparian study area): undertaken in May 2013.

A total of 388 discrete vascular flora taxa and nine hybrids were recorded in the Compiled Study Area during these surveys, including 373 native taxa and 15 introduced taxa, representing 51 families and 165 genera. Four conservation significant (Priority) flora taxa were recorded during the surveys, one being of Priority 1 status. No T-DRF taxa were recorded. Fifteen introduced flora taxa were recorded in the Compiled Study Area.

Nineteen Vegetation Types (VTs) (including four VTs being split into two subgroups each) were mapped in the Compiled Study Area, comprising three super-groups. The super-groups were based primarily on topographical location within the Study Area and the water-retention capacity of the landforms and associated soils. Three of these VTs (VTs 13, 14 and 15) contain areas which are of potential groundwater dependence.

None of the VTs recorded in the Compiled Study Area represent any known Threatened Ecological Communities (TECs). The Study Area falls within the buffer of the 'Stony saline clay plains of the Mosquito Land System' Priority Ecological Community (PEC) however none of the VTs described represent this PEC. The occurrence of the Study Area within the PEC buffer is therefore considered not to be of significance. Six VTs are described as being of local significance, due to a combination of restricted nature within the Compiled Study Area and soil types and landforms associated with these VTs. Of these, VTs 5, 8a and 8b are also noted to be of potential regional significance, due to the restricted known distribution of these VTs in the wider region.

The condition of vegetation recorded in the Compiled Study Area ranged from Excellent to Very Poor, with the majority classified as Excellent or Good. Factors influencing the vegetation condition were the presence of introduced species such as *Cenchrus ciliaris* (Buffel Grass) and high grazing and trampling impacts from cattle, with generally lower levels of condition mapped in the Riparian Study Area.

1. INTRODUCTION

1.1 Project History

The McPhee Creek Project is located in the Pilbara Region of Western Australia, 220km south-east of Port Hedland, 220km north of Newman and 5km east of the Marble Bar – Nullagine Road (Figure 1).

Atlas Iron Limited has project tenements at McPhee Creek, with JORC compliant iron ore resources of 224.7 million tonnes (Mt). The McPhee Creek Project involves developing a greenfield mine and processing operation. The operation has the potential to deliver a fines product up to a rate of 15Mtpa, provided that the required port and transport infrastructure is available.

The McPhee Creek (Main Range) bedded iron deposit was originally discovered by Giralia Resources (Giralia). Atlas Iron acquired Giralia in March 2011 in an off-market takeover and continued exploration drilling across the project from June 2011. Prior to the take-over by Atlas, Giralia had completed a scoping study for McPhee Creek, which essentially proposed a 2Mtpa DSO operation, hauling to port via on-highway road-trains.

In September 2011, Atlas revisited the scoping study, and some sort of beneficiation was recognised to be required as a result of the resource statement for McPhee Creek in 2011. The updated Atlas 2013 reserve statement demonstrated that the DSO had increased by 98% and the lower grade (BFO) reserve had reduced in size, resulting in a 15Mtpa DSO operation as the new reference case (defined in the Pre-feasibility Study report).

Atlas Iron Pty Ltd (Atlas Iron) is currently revisiting the McPhee Creek Project and undergoing some further project investigations. Atlas Iron are currently undertaking biological and heritage studies to further the project towards Environmental Protection Authority (EPA) referral under Section 38 of the *Environmental Protection Act 1986* (EP Act) (State) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth). These works, including a Flora and Vegetation Desktop Assessment will be used to inform next steps and support discussions with regulators regarding the projects factors of significance.

1.2 McPhee Creek Project Description and Study Area Description

Atlas proposes to develop the McPhee Creek project involving the development of a greenfield mine and processing operation, centred on the McPhee Creek deposit. The deposit contains approximately 260 million tonnes (Mt) of banded iron formation (BIF) haematite/goethite which is expected to be mined in six pits: Avon (developed as two separate pits), Murray, Ord, Gascoyne and Nicholson with mining expected to be undertaken at a rate of around 15Mtpa. Mining is proposed to occur below the existing groundwater table and development of the proposed mining pits to their full extent will active require dewatering of the orebody aquifers and disposal of excess dewater. A bulk haulage solution for the project will be addressed and referred to the EPA and under the EPBCA Act as necessary separately to the proposed Mine.

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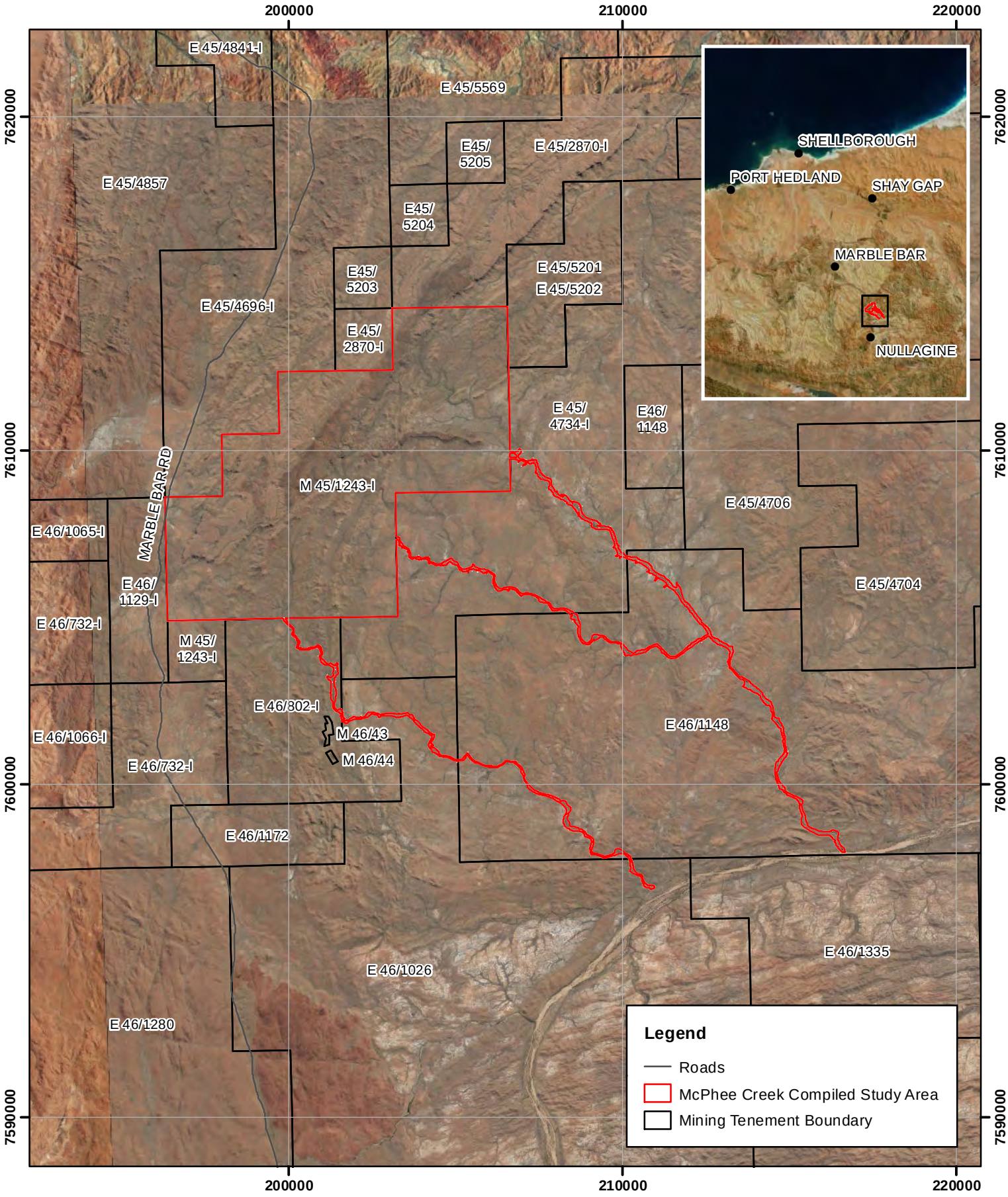

McPhee Creek Compiled Study Area, Regional Location and Tenement Information	Author: Leah Firth	N
	WEC Ref: Atlas19-27-01	
WOODMAN ENVIRONMENTAL	Filename: Atlas19-27-01-f01.mxd	**Figure**
	Scale: 1:150,000 (A4)	1
	Projection: GDA 1994 MGA Zone 51	
This map should only be used in conjunction with WEC report Atlas19-27-01.	Revision: 0- 29 August 2019	

For the purposes of this report, the 'Compiled Study Area' refers to the combined McPhee Creek Study Area (Woodman Environmental 2014a) and the Riparian Study Area (Woodman Environmental 2014b) (Figure 2). The Compiled Study Area covers approximately 6429 hectares, and the Project Area is located directly within the Compiled Study Area.

1.3 Background of Flora and Vegetation Assessment

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) has undertaken various flora and vegetation surveys of the McPhee Creek project area as described below.

A desktop review of the relevant flora and vegetation available information for the project area was undertaken in 2011 (Woodman Environmental 2011a). The aims of this report were to develop local and regional context for the environment of the project; to identify known flora and vegetation of significance from the area; and to develop a Study Area design for the flora and vegetation survey of the Project. This was undertaken in accordance with the requirements of the EPA Guidance Statement No. 51 (EPA 2004) and to the satisfaction of both the Department of Environment and Conservation (DEC) (now the Department of Biodiversity, Conservation and Attractions (DBCA)) and Atlas Iron (Woodman Environmental 2011a).

Following the desktop review, a flora and vegetation Level 2 survey of the McPhee Creek Study Area was undertaken in May 2012 (Woodman Environmental 2014a). Vegetation Types and vegetation condition were defined and mapped across that Study Area, and records taken of conservation significant flora taxa encountered. All survey and reporting methods were undertaken in accordance with EPA (2004).

A survey for significant flora taxa which had been identified during the May 2012 survey, as well as those defined in the desktop review (Woodman Environmental 2011a) was undertaken in April 2013 (Woodman Environmental 2013a). The search was undertaken using a search pattern based on existing knowledge of habitat requirements for the targeted taxa. Any occurrences of the potentially saline areas that may have constituted outlying occurrences of the Mosquito Creek Priority Ecological Community (PEC) were also targeted for survey.

Following these surveys, the vegetation of three separate creeklines which were at potential risk of impact by discharge associated with the minesite activities was surveyed and mapped (Riparian study area), using the same techniques as that undertaken by Woodman Environmental (2014a). All quadrat data collected both within the mine project area and the Riparian study area were used in the analysis, and although only the VT mapping was presented in that report (Woodman Environmental 2014b), the mapping was undertaken to allow a complete overview assessment of both Study Areas.

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7620000 7615000 7610000 7605000 7600000 7595000 7590000 7585000

MARBLE BAR RD

Nullagine River

Nullagine River

Nullagine River

SPEC MIN

Legend

- Study Area (Atlas 11-47)
- Riparian Vegetation Mapping Study Area (Atlas 13-17)
- Roads
- Hydrography

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McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f02.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

2

1.4 Aim and Objectives

Woodman Environmental (2019) undertook an initial gap analysis of the current project parameters, including survey work and reporting that had been undertaken as described in section 1.3, against the current factor and survey guidelines as prepared by the EPA (EPA 2016a; b) and the current *Biodiversity Conservation Act 2016* (BC Act). The gap analysis presented tasks which would be required to update the data and reporting as described above to meet current guidelines. These are presented in Table 1.

The following tasks were also noted to be required, and have been undertaken for this report:

- Update taxonomy of all species
- Update conservation status of all species
- Update conservation status of vegetation
- Undertake new database searches (DBCA)
- Assess the vegetation to determine whether any units are considered to be groundwater dependent

The aim of this report is to provide current flora and vegetation assessment information for the entire McPhee creek survey area, including the McPhee Creek Study Area (Woodman Environmental 2014a) and the Riparian Study Area (Woodman Environmental 2014b), to a standard acceptable under EPA (2016a) and the BC Act, as per Table 1 and presented on Figure 2.

1.5 Level of Assessment

The assessment was originally undertaken as a Level 2 flora and vegetation survey, as defined by the EPA Guidance Statement No. 51 (EPA 2004), as this was the current guidance at the time of the original surveys. The information provided in this report for the McPhee Creek Compiled Study Area (Figure 2) conform to the requirements of both a Targeted Survey and Detailed Survey as defined in Sections 4.1 and 4.2 of the 'Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA 2016a), which has superseded EPA Guidance Statement No. 51 (EPA 2004).

This report presents the desktop literature review results for the McPhee Creek Compiled Study Area (Compiled Study Area), as well as flora and vegetation survey and reporting results. The desktop review is presented in Section 5.1; the field survey and mapping results are presented in Section 5.2.

Table 1: Gap Analysis Recommendations

Guidance Requirement	Gap	Recommendation	Section
A table to be provided with the area (hectares) and associated condition rating of the Study Area	No table presented (Atlas11-65-01)	Present table in revised report	5.2.4.3
Botanists must demonstrate that adequate sampling effort has been undertaken to enable an assessment of the proposal's impacts on flora and vegetation.	No tracklogs presented; data in relation to percentage of study area surveyed (Atlas11-65-01)	Present in revised report	4.1 Figure 7
Species accumulation curves will generally indicate if an area has been adequately sampled.	No species accumulation curve presented (Atlas11-65-01)	Present table in revised report	4.1.2; Figure 8
Maps to contain aerial photography with transparent layers to enable aerial photography to be seen	Not presented (Atlas11-65-01)	Present in revised report	Appendix 0
Land System/soil/geological mapping	Not presented (Atlas11-65-01)	Present in revised report	Figure 6 (Land system mapping)
Mapping of regional vegetation units or other relevant regional data	Not presented (Atlas11-65-01)	Present in revised report	Figure 11 (Vegetation system associations)
Sampling effort - GPS tracks and/or location of sampling sites	Not presented (Atlas11-65-01)	Present in revised report	Figure 7
All potentially suitable habitats to be systematically searched for significant flora or vegetation	Partially undertaken (Atlas11-06-01); not undertaken in southern area (Atlas14-17-01)	Review requirements for survey in this area and undertake survey as required	4.1
Local and regional distribution of significant vegetation	Not presented (Atlas11-65-01)	Present in revised report	5.2.4.5
Discussion of relationships between vegetation units and regional units	Not presented (Atlas11-65-01)	Present in revised report	5.2.4.2
Values and significance of the flora and vegetation at a local and regional context	Partially presented (Atlas11-65-01)	Regional significance of vegetation to be assessed against broader vegetation datasets and references and presented in revised report	5.2.4.5
Raw data to be provided electronically (Index for Biodiversity Surveys for Assessment (IBSA) format)	No data provided to date (Atlas11-65-01; Atlas13-06-01)	Data to be provided to client as IBSA format package	IBSA Dataset provided
Appendices with significant flora/vegetation data to be noted as being for government agent reference only	Not presented (Atlas11-65-01; Atlas13-06-01))	Present in revised report	Appendices F, H, O

2. BACKGROUND

2.1 Land Tenure

The Compiled Study Area is predominantly located on and surrounded by pastoral stations and Unallocated Crown Land. In addition, the Compiled Study Area is covered by the following mining leases and exploration licences (Figure 1):

- Proposed minesite and processing facilities - M 45/1243-1
- Three potential riparian discharge options - E 45/4734-1, E 46/1148, E46/1026, E46/802-1

The northern half of M 45/1243-1 is located on Unallocated Crown Land (UCL); the southern half is located on Bonney Downs, a privately held pastoral station. The Riparian study area is also located on Bonney Downs station (Figure 3).

The nearest conservation tenure is located 11.5km to the north east of the north-eastern extent of the Compiled Study Area; this area is designated as UCL of which DBCA has conservation interest (ex-Meentheena Station). Another area of the similar tenure is located 100km to the south-west of the Compiled Study Area. Otherwise, the nearest formal conservation reserves are located approximately 160km to the west (Mungaroona Range Nature Reserve); 165km to the south-west (Karajini National Park); and 170km to the south-east (Karlamilyi National Park).

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R 19459
R 145
19460
MARBLE BAR ROAD
UCL
R 50151
R 12347
R 13688
MARBLE BAR RD
R 12348
ROAD
L PL N050430
BONNEY DOWNS STATION
93
R 14728
R 9700

Legend

- McPhee Creek Compiled Study Area
- Land Tenure Information
- Roads

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Land tenure of the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f03.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

3

2.2 Climate

The Study Area is located in the Pilbara region of Western Australia, experiencing an arid tropical climate with predominantly summer rainfall (Beard 1990), and is strongly influenced by summer cyclones (occurring from November to April). The prevalence of such cyclonic events results in the Pilbara region receiving higher average annual rainfall (250 – 300 mm) than the remainder of the Eremaean Province (Beard 1990; Bureau of Meteorology 2019a).

Figure 4 displays monthly precipitation totals and average maximum temperature for 2012 and 2013, providing data for the months preceding field survey dates (May 2012, April-May 2013), as well as long-term average monthly maximum temperature (2000-2019) and average monthly precipitation (2000-2019) recorded for Marble Bar (all months shown), the nearest meteorological station to the Study Area (Bureau of Meteorology 2019b).

The precipitation in the four months (January to April) preceding the field surveys in May 2012 was above the long-term average, with a total of 316 mm received compared to the long-term average for this period of 285 mm. The precipitation in the four months (January to April) preceding the field surveys in April and May 2013 was also above the long-term average, with a total of 290 mm received compared to the long-term average for this period of 285 mm (Figure 4).

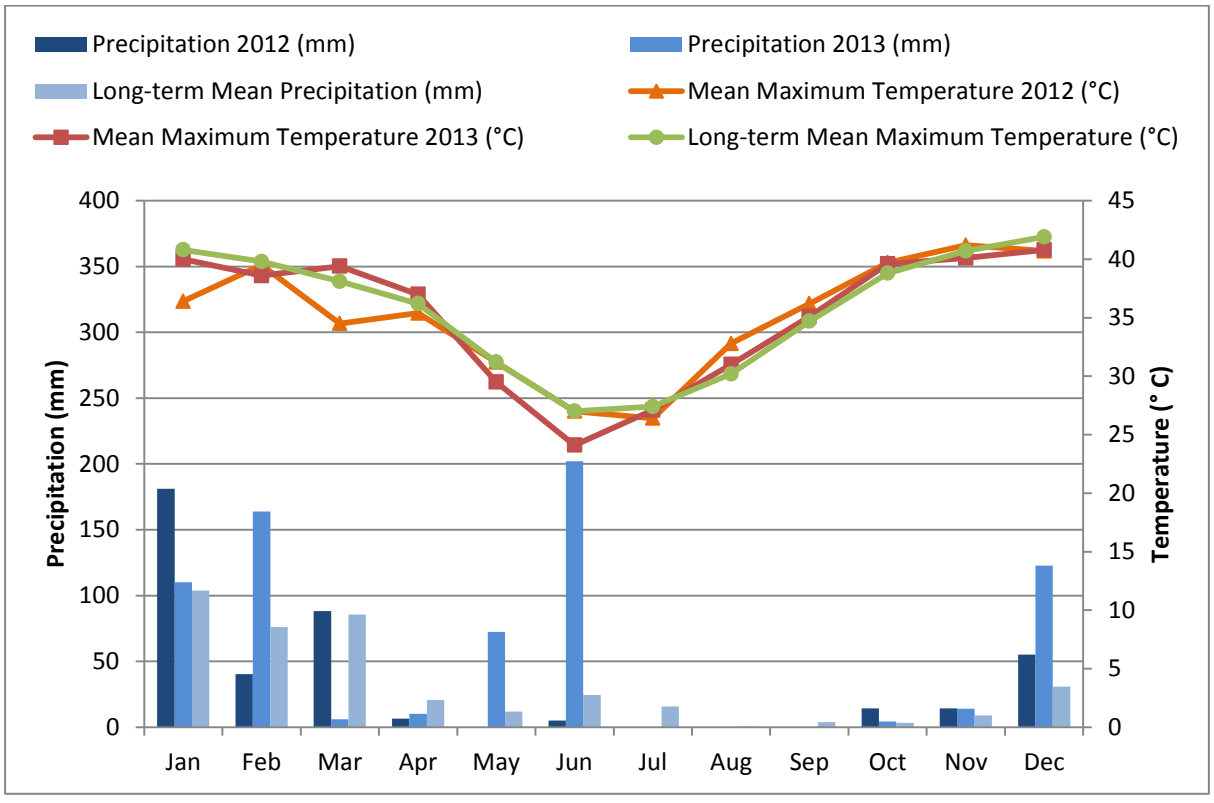


Figure 4: **Mean Maximum Temperature and Total Precipitation for 2012 and 2013, and Long-Term Average Monthly Maximum Temperature and Precipitation, for Marble Bar (Bureau of Meteorology 2019b)**

2.3 Regional Geology, Landforms and Soils

The Compiled Study Area is located in the Pilbara region (Fortescue Botanical District) as defined by Beard (1975; 1990). This is equivalent to the Pilbara Interim Biogeographic Regionalisation for Australia (IBRA) region (Commonwealth of Australia 2012). The Pilbara region is formed of a basement of Archaean granite and volcanics, overlain by massive deposits of Proterozoic sediments and volcanics (Beard 1990). This region is generally mountainous, rising to 1250 m (metres), with hard alkaline red soils on plains and pediments, and shallow and skeletal soils on ranges. The Study Area traverses two physiographic regions as defined by Beard (1975); the Abydos Plain and the George Ranges. This area is also equivalent to the Chichester IBRA subregion (Commonwealth of Australia 2012).

The Abydos Plain is alluvial in origin near the coast, and of Archaean granite origin further inland. It consists of a variety of features including alluvial plains, pediplains, low stony hills and dissected pediments, low granite outcrops and tors, and basic dykes. It is divided into a number of isolated sections by the Gorge Ranges. The main soils are hard alkaline red soils, some areas with coarse textured A-horizons to 45 cm thick, while other areas have shallow stony A-horizons in addition to patches of calcrete. On the eastern part of the plain near the De Grey River, the soils are chiefly neutral and acidic red earths, while on the inland plains behind the Gorge Ranges the chief soils are earthy loams and coarse sands overlying granite within 90 cm of the soil surface. The alluvial plains along the coast generally consist of red earthy sands with extensive areas of red earths, and hard red soils along creek lines. Deep cracking clays occur in the vicinity of residuals of basic and ultrabasic rocks in the Roebourne area (Beard 1975).

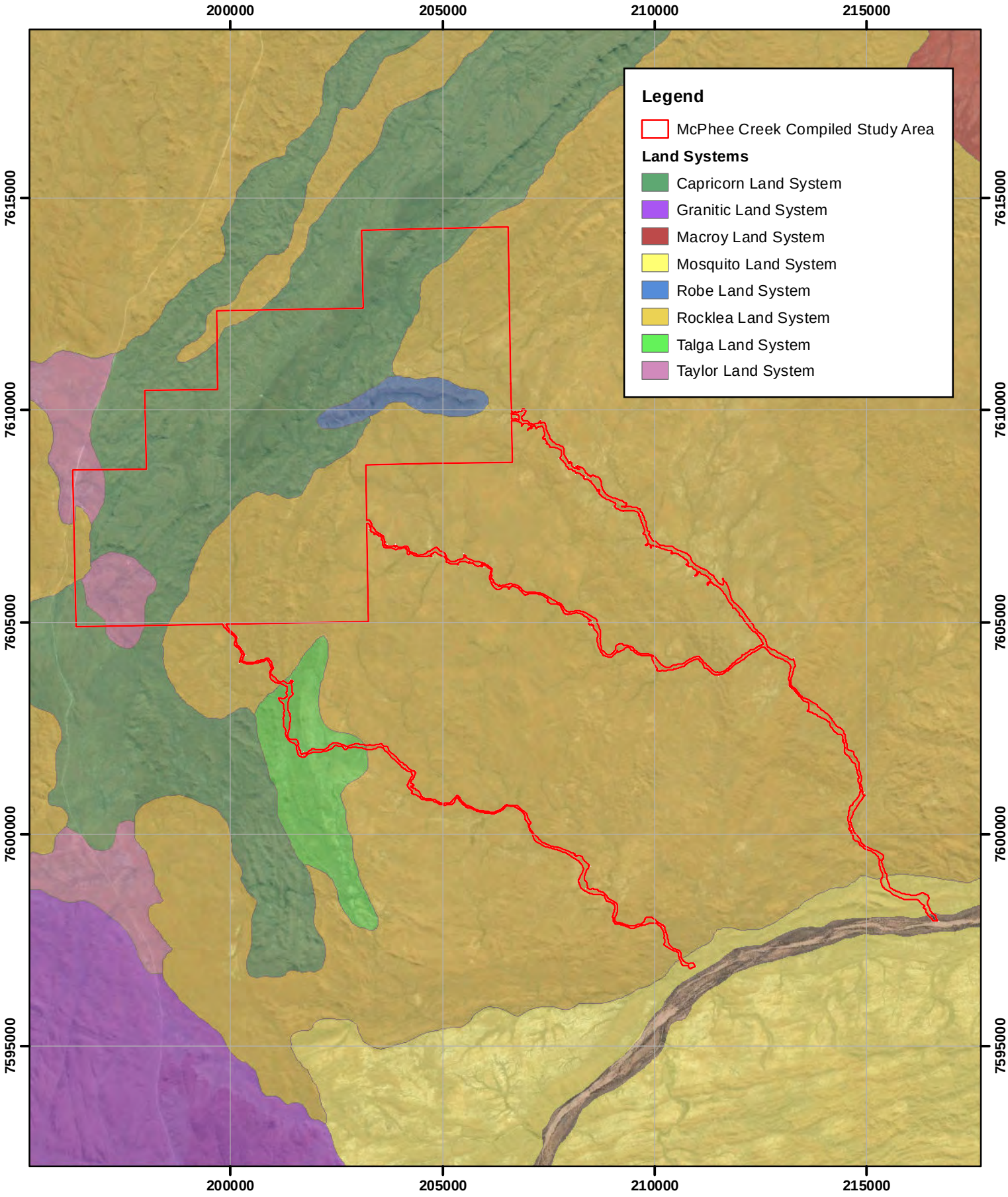
The George Ranges are a rough, steep and abrupt range dissected by a number of rivers through narrow gorges. These ranges consist of Archaean and Lower Proterozoic rocks of sedimentary and volcanic origin, with basic lavas along with dolomites, tuff, banded-iron formations and dolerite dykes, with some narrow valley-plains and high-level gently undulating areas of limited extent. The soils are generally shallow and stony, with large areas without soil cover. Chief soils are brown loams with significant areas of earthy loams soils, with hard alkaline red soils occurring on lower slopes, and cracking and non-cracking clays on valley floors (Beard 1975).

In 2004, the Department of Agriculture described land systems within the Pilbara IBRA region, considering geology and soils, general ecological information, vegetation physiognomy and composition, patterns of variation, conservation status, gradational association and land system representation (van Vreeswyk *et al.* 2004). A number of these land systems have since been listed as PECs by the DBCA (DBCA 2019a). The Compiled Study Area is located on six land systems as summarised in Table 2 and presented on Figure 5.

Table 2: Land Systems Intersecting the Compiled Study Area (van Vreeswyk *et al*. 2004)

Land System	Mapped Extent (ha) (percentage of Pilbara Study Area)	Description of Land System
Capricorn	529,600 2.9%	Hills and ridges of sandstone and dolomite supporting shrubby hard and soft spinifex grasslands **Geology** Lower Proterozoic sandstone, greywacke, dolomite and shale **Geomorphology** Erosional surfaces; ranges and hills with steep rocky upper slopes, more gently sloping stony footslopes, restricted stony lower plains and valleys; moderately spaced tributary drainage patterns. Relief up to 180 m **Landforms** • Ridges, Hills and Upper slopes (70%) • Lower footslopes (20%) • Stony Plains (5%) • Narrow drainage floor and channels (5%)
Mosquito	184,000 1%	Stony plains and prominent ridges of schist and other metamorphic rocks supporting hard spinifex grasslands **Geology** Archaean schist, greywacke, gabbro and minor conglomerate **Geomorphology** Erosional surfaces; stony plains and pediments with prominent ridges and hills with steep upper slopes and short more gently inclined footslopes, moderately spaced tributary flow lines and channels. Relief up to 100 m. **Landforms** • Ridges and Hills (40%) • Lower footslopes (10%) • Stony Plains (15%) • Stony Saline Plains (25%) • Drainage lines and channels (10%)
Robe	86,500 0.5%	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands **Geology** Tertiary pisolitic limonite and laterite (Robe pisolite). **Geomorphology** Erosional surfaces; formed by partial dissection of old Tertiary surfaces, dissected plateaux and long lines of low mesas along present and past river valleys, indented near vertical breakaway faces and steep slopes with limonite outcrop and pisolitic gravelly mantles, restricted gravelly lower slopes and closely to moderately spaced narrow tributary drainage floors. Relief up to 50 m. **Landforms** • Low plateaux, mesas and buttes (60%) • Lower slopes (20%) • Gravelly plains (15%) • Drainage floors and channels (5%)

Land System	Mapped Extent (ha) (percentage of Pilbara Study Area)	Description of Land System
Rocklea	2,299,300 12.7%	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands **Geology** Archaean basalt, Lower Proterozoic basalt, dolerite, tuff and agglomerate, minor shale and jaspilite **Geomorphology** Erosional surfaces; hills, ridges and plateaux remnants on basalt with steep stony slopes, restricted lower slopes, stony interfluves and minor gilgai plains; moderately spaced tributary drainage patterns of small channels in shallow valleys in upper parts becoming broader floors and channels downslope. Relief up to 110 m **Landforms** • Hills, ridges, plateaux and upper slopes (65%& • Lower slopes (155) • Stony plains and interfluves (10%) • Gilgai plains (1%) • Upper drainage lines (4%) • Drainage floors and channels (5%)
Talga	212,400 1.2%	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands **Geology** Archaean basic volcanics, ultramafic rocks and other metamorphics, basalt, andesite, shale, slate, chert and Quaternary colluvium **Geomorphology** Erosional surfaces; hill tracts and ridges on basalt, greenstones, schist, other metamorphics and chert with rocky rounded crests and ridge tops extending for many kilometres; very steep upper slopes, more gently inclined lower footslopes, restricted lower stony plains and interfluves; moderately spaced tributary and strike aligned drainage floors and channels. Relief is up to about 100 m. **Landforms** • Hills and ridges (5050 • Lower footslopes (30%) • Stony plains (15%) • Drainage floors and channels (5%)
Taylor	12,900 0.07%	Stony plains and isolated low hills of sedimentary rocks supporting hard and soft spinifex grasslands **Geology** Proterozoic sandstone, grit, conglomerate and shale. **Geomorphology** Erosional surfaces; gently undulating stony plains and pediments with occasional low hills with relief up to 20 m, minor sandy surfaced plains and moderately spaced tributary drainage floors and channels. **Landforms** • Hills (3%) • Stony plains (72%) • Sandy surfaced plains (10%) • Drainage floors (15%)



Landsystems of the McPhee Creek Compiled Study Area	Author: Leah Firth	N
	WEC Ref: Atlas19-27-01	
WOODMAN ENVIRONMENTAL	Filename: Atlas19-27-01-f05.mxd	**Figure**
	Scale: 1:118,024 (A4)	5
	Projection: GDA 1994 MGA Zone 51	
This map should only be used in conjunction with WEC report Atlas19-27-01.	Revision: 0- 29 August 2019	

3. METHODS

3.1 Desktop Review

Prior to commencement of the field survey, a review of all publicly available flora and vegetation data relevant to the particular surveys was undertaken; this included obtaining and reviewing copies of reports of previous biological surveys carried out within the vicinity of the various Study Areas and interrogation of relevant databases, as listed in Table 3. Updated information (current 2019) from these databases and sources have been obtained and included in this report.

Table 3: Searches Undertaken for the Desktop Study of the Compiled Study Area

Source	Search Attributes	Search Purpose
DBCA Threatened and Priority Ecological Communities Databases DBCA (2019c)	Study Area with 50 km buffer - DBCA dataset request	Obtain records of DBCA-classified TECs and/or DBCA-classified PECs within or within the vicinity of the Study Area
DBCA TEC and PEC lists (DBCA 2018, 2019a)	Review of current DBCA TEC and PEC lists	Identify whether there are any other additional DBCA listed TECs or PECs which could occur within the vicinity of the Study Area
DBCA Significant Flora Databases (WA Herbarium specimen database and Threatened and Priority Flora (TPFL) database) (DBCA 2019d)	Study Area with 50 km buffer - DBCA dataset request	Obtain records of listed significant flora within or within the vicinity of the Study Area
Department of the Environment and Energy (DoEE) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool DoEE (2019)	Study Area with 40 km buffer performed prior to survey, updated 03/07/2019	Identify taxa or ecological communities listed as Threatened (also referred to as Matters of National Environmental Significance (MNES)) under the EPBC Act that have the potential to occur within or within the vicinity of the Study Area
DBCA *NatureMap* (WA Herbarium and TPFL records) DBCA (2007-)	Study Area with 40 km buffer performed prior to survey, updated 2/7/19	Confirm significant flora records and identify introduced flora and known from the vicinity of the Study Area
IBSA Dataset Search conducted July 2019 Department of Water and Environmental Regulation (DWER) (2019)	120km radius surrounding McPhee Creek study area	Identify other regional flora and vegetation surveys conducted in the region
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis Government of Western Australia (2019)	Study Area	Identify extent of Vegetation System Associations within the Study Area
An inventory and condition survey of the Pilbara region, Western Australia, Technical Bulletin No. 92 (van Vreeswyk *et al.* 2004)	Study Area	Identify extent of Land Systems within the Study Area

3.2 Personnel and Licensing

Table 4 lists the personnel involved in both fieldwork and plant identifications for the three field surveys:

- Atlas 11-65 (Detailed (Level 2) flora and vegetation survey of the McPhee Creek Study Area) (Woodman Environmental 2014a)
- Atlas 13-06 (Targeted flora and vegetation survey of the McPhee Creek Study Area) (Woodman Environmental 2013a)
- Atlas 13-17 (Detailed (Level 2) vegetation survey of the riparian study area) (Woodman Environmental 2014b)

All personnel undertaking the field surveys had previous experience undertaking similar surveys, with the Project Managers and field team leaders having extensive previous experience in conducting flora surveys in the Pilbara Bioregion. All plant material was collected under the scientific licences pursuant to the *Wildlife Conservation Act 1950* (WC Act) Section 23C as listed in Table 4. Note the WC Act has been superseded by the *Biodiversity Conservation Act 2016* (BC Act). However the WC Act was in force at the time these flora collecting permits were issued.

Table 4: Personnel and Licensing Information

Personnel	Role	Report	Flora Collecting Permits
Kim Kershaw	Project Manager; Field Team Leader	Atlas 13-17	SL010497 / 136-1213
	Field Team Member	Atlas 13-06	
	Field Team Leader	Atlas 11-65	SL009957 / 147-1112
Greg Woodman	Field Team Leader	Atlas 11-65	SL009959 / 144-1112
David Coultas	Field Team Leader	Atlas 13-06	SL010499 / 137-1213
	Field Team Member	Atlas 11-65	SL009406 / 148-1112
Sam Coultas	Field Team Member	Atlas 13-17	SL010505
	Field Team Member	Atlas 13-06	
John Grantham	Field Team Member	Atlas 13-17	SL010502 / 138-1213
	Field Team Member	Atlas 11-65	SL009434
Terri Jones	Field Team Member	Atlas 11-65	SL009952
Bethea Loudon	Project Manager; Field Team Leader	Atlas 13-06	SL010498 / 139-1213
	Project Manager; Field Team Leader	Atlas 11-65	SL009953 / 150-1112
Lisa McFarlane	Field Team Member	Atlas 11-65	SL009958
Alison Saligari	Field Team Leader	Atlas 13-17	SL010500 / 138-1213
	Field Team Member	Atlas 13-06	
Frank Obbens	Plant Identifications	Atlas 13-17	n/a
Sharnya Thomson	Plant Identifications	Atlas 11-65	n/a

3.3 Vegetation Type Survey and Definition

The VT mapping and condition assessment presented in this report is that as analysed and mapped in Woodman Environmental (2014a). Some minor clearing has occurred in the McPhee Creek study area since the original vegetation survey was undertaken; most notably tracks, a camp area and clearing associated with exploration. These areas can be seen on

the aerial photography imagery as presented in Appendices O (Sheets O2; O5; O6-O10) and P (Sheets P2; P5; P6-P10).

3.3.1 Aerial Photography Interpretation and Survey Design

Prior to vegetation field surveys, initial interpretation of ortho-rectified aerial photography at a scale of 1:10,000 was conducted to determine preliminary vegetation patterns present within the Study Areas, with quadrats allocated based on these patterns. A minimum of three quadrats were allocated to each discernible vegetation pattern where possible; such replication is required for meaningful results to be produced following classification analysis of quadrat data, and to provide local context for VT distribution.

3.3.2 Field Survey Methods

The field surveys comprised of three field survey timings:

- Detailed Vegetation survey (McPhee Creek study area): 7th to 14th and 21st to 27th May 2012 (Atlas11-65)
- Detailed vegetation survey (Riparian study area): 24th to 29th May 2013 (Atlas13-17)

A total of 164 non-permanent flora survey quadrats, each covering an area of 2500 m^2, measuring either 50 m x 50 m or 100 m x 25 m (for creek lines) were established during the detailed surveys. This quadrat size is the indicative size used in flora and vegetation surveys in the Pilbara Bioregion, as outlined in Table 1 of EPA (2016a). Quadrat locations were selected to ensure that at least three quadrats were surveyed within each vegetation pattern initially identified from aerial photography interpretation (if possible). All quadrats established in the McPhee Creek study area (Atlas11-65) were prefixed with 'MC'; the quadrats established in the Riparian study area (Atlas13-17) were prefixed with 'MCC'.

The quadrats were accessed via vehicle where possible, using available tracks and public roads, and also traversed on foot. Helicopter support was used to reach quadrats that were inaccessible via vehicle during the riparian vegetation survey only.

All vascular flora taxa that were visually identifiable within each quadrat were recorded. At least one reference specimen of most taxa (excluding common, distinctive taxa) encountered was collected for verification and identification purposes.

The following information was recorded at each quadrat:

- Personnel;
- Unique quadrat number;
- Date of survey;
- GPS (Global Positioning System) coordinates (GDA (Geocentric Datum of Australia) 94);
- Site photograph;
- Topography (including landform type and aspect);
- Soil colour and type (including the presence of any rock outcropping and surface stones);
- Vegetation condition (EPA 2016a; scale presented in Appendix D);
- Approximate time since fire;

- Presence and type of disturbance (if any);
- Percentage foliage cover (for each taxon, including cover within the quadrat of individuals rooted outside of the quadrat);
- Height (m) (average for each taxon, excluding climbers/aerial shrubs); and
- Additional flora taxa present outside of the quadrat but within the vegetation type of the quadrat (no cover recorded).

Mapping notes of vegetation pattern boundaries and distribution was undertaken while traversing the Study Areas on foot, to aid in mapping polygons of vegetation patterns that were not allocated quadrats. Not all vegetation pattern polygons received quadrats because of time constraints, however many polygons could be confidently allocated to a final VT using a combination of mapping notes and aerial photograph interpretation. Additional flora taxa were also recorded opportunistically in the Study Area via a search in the general vicinity of each quadrat, and during traverses on foot between quadrats.

Locations of any significant and introduced flora taxa encountered while traversing between quadrats and relevés, were recorded, including the location and number of individuals. All areas traversed in the Study Area were recorded as track logs.

3.3.3 Plant Collection and Identification

Specimens of any unknown taxa were collected and pressed for later identification at the WA Herbarium. External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest.

Taxon nomenclature generally follows *FloraBase* (WA Herbarium 1998-) with all names checked against the current DBCA Max database to ensure their validity. In cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on *FloraBase*, nomenclature in the published literature is followed. The conservation status of each taxon was checked against *FloraBase*, which provides the most up-to-date information regarding the conservation status of flora taxa in Western Australia. All plant nomenclature and conservation status have been updated during this current review.

Specimens of interest, including significant flora taxa, range extensions of taxa and potential new taxa, are sent to the WA Herbarium for consideration for vouchering as soon as practicable. However this process is via donation and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering is supported by completed Threatened and Priority Flora Report Forms submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (e.g. Threatened and Priority flora taxa).

3.3.4 Floristic Analysis

For the Riparian study area survey (Woodman Environmental 2014b)) the classification analysis of floristic data was conducted using data from all 164 quadrats established in the entire Compiled Study Area, including the 125 quadrats from the initial vegetation mapping and the 39 quadrats from the riparian vegetation assessment.

Classification and ordination analyses were conducted on a data matrix compiled from the quadrat data, with introduced taxa, putative hybrids and opportunistic recordings (i.e. those taxa recorded outside of the quadrat) excluded from the analysis. Singletons (taxa recorded only once in the quadrat dataset) and ephemeral (short-lived) taxa were included in the analysis. Various taxa were grouped together within the data matrix for the analysis where taxonomy was unclear or where different infra-taxa were identified within the dataset and not correlated to plant community, landform or soil type. Some taxa were omitted from the analysis as they could not be positively identified because of inadequate material (see Appendix H).

Pattern analysis was conducted using PATN (V3.03) (Belbin 2009). The Bray-Curtis coefficient was used to generate an association matrix for both the classification and ordination analyses. This association matrix consisted of pairwise coefficients of similarities between quadrats based on floristic data. Agglomerative, hierarchical clustering, using flexible UPGMA (ß=-0.1) was used to generate a species and quadrat classification (Sneath and Sokal 1973). A two-way table of the species and quadrat matrix was produced, with the matrix sorted into groups generated from the species and quadrat classification. Indicator species analysis (INDVAL) was conducted using PC-Ord (McCune and Mefford 1999) using the method of Dufrene and Legendre (1997). The INDVAL measures were used to determine the indicator species for each VT and a Monte Carlo permutation test was used to test for the significance of the indicator species.

3.3.5 Vegetation Type Definition, Mapping and Description

The classification analysis of Compiled Study Area floristic data aggregated quadrats into a cluster classification. The resulting dendrogram and taxon group matrix were initially examined at a cluster level determined by PATN as potentially appropriate for the dataset, to determine the plausibility of clusters with regard to taxon groups, as well as field observations and indicator taxon analysis. This process determined a final number of clusters, which were considered to represent Vegetation Types (VTs). The locations of quadrats within each VT were used in conjunction with aerial photograph interpretation and field notes taken during survey to develop VT mapping polygon boundaries. These VT mapping polygon boundaries were then digitised using Geographic Information System (GIS) software.

VT descriptions (though floristic in origin) have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units. This model follows nationally agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, it is considered that a VT is equivalent to a NVIS sub-association as described in ESCAVI (2003). Common taxa within each stratum were defined as taxa that occurred in 30 % or greater of quadrats established within a particular VT; this may not include all taxa in the VT description, as the description is based on dominance within each stratum, as well as the frequency that a taxon was recorded within each VT.

For each VT, indicator taxa were defined via Indicator Taxon Analysis (INDVAL). This was conducted using PC-Ord (McCune & Mefford 2011) via the method of Dufrene & Legendre

(1997). This generates INDVAL values (a measure of taxon fidelity to a given VT), which range from 0 to 100; an INDVAL value of 100 indicates that a taxon is present in all quadrats within a particular VT, and absent from all other quadrats included in the analysis. The INDVAL values were then tested for significance of the indicator taxa using a Monte Carlo permutation test.

3.3.6 Vegetation Condition Mapping

Vegetation condition was described using the vegetation condition scale presented in EPA (2016a) (Appendix D). Notes on vegetation condition were taken during the field survey via vehicle traverses along tracks, and during foot traverses undertaken to search for significant flora taxa or while traversing between quadrats. Vegetation condition was also recorded at all quadrats. Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation and were digitised as for vegetation mapping polygon boundaries.

3.3.7 Assessment of Significance of Vegetation

A qualitative assessment of the potential local and regional significance of the vegetation is provided. A VT can be considered to be of local significance if it is characterised by the presence of a significant flora taxon; and/or it is otherwise restricted in the local survey area (<1% of area mapped); or otherwise occurs on restricted landforms or soil types. Limited information regarding the regional distribution of VTs is available for the Pilbara Region. Although a regional survey of the Pilbara Region was undertaken by the DBCA, no reports detailing vegetation on a regional scale are yet available. Studies by Beard (1975) and van Vreeswyk *et al.* (2004) characterised the vegetation of the Pilbara region, however not at a scale appropriate for Environmental Impact Assessment (EIA).

Mapping of the vegetation at Corunna Downs (Woodman Environmental 2014e) utilised quadrat data from a variety of regional surveys undertaken by Woodman Environmental. Quadrat data used in that analysis were assessed at Mount Webber, McPhee Creek (Study Area; Riparian study area; haul road; rail spur projects and at Corunna Downs (Woodman Environmental 2012; 2014a; 2014b; 2014c; 2014d; 2014e respectively). That analysis has been referenced to provide some context in terms of the potential regional distribution of VTs of the Compiled Study Area. It must be noted that the Compiled Study Area is located furthest east of any of these survey areas (Figure 9).

3.4 Significant Flora and Vegetation Survey

3.4.1 Significant Flora

EPA (2016b) defines flora taxa to be considered significant for a range of reasons, including, but not limited to the following:

- Being identified as a Threatened or Priority species (listed significant taxa – includes taxa listed under both State and Commonwealth legislation) (conservation codes as for Western Australian flora and fauna as per DBCA (2019a) presented in Appendix B);
- Locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;

- Representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

A target list of significant flora taxa likely to be encountered was compiled as part of the Desktop Study component. Areas of habitat within the McPhee Creek study area considered suitable for the targeted flora survey were traversed on foot, either in parallel transects along hilly terrain, or using a grid pattern with grid lines parallel and aligned predominantly north-south, dependent on the habitat and terrain being traversed. This survey was undertaken from 8th to 15th and 22nd to 29th April 2013.

Grid lines were generally conducted 100 m apart with this distance deemed appropriate both in terms of time efficiency (in order to cover prioritised sections of the Project Area) and data quality, as two of the main conservation significant flora taxa being targeted (*Acacia aphanoclada* (P1) and *Ptilotus mollis* (P4)) can usually be seen for some distance (which are then approached to confirm identification). In areas of habitat where *Eragrostis crateriformis* (P3) was considered likely to occur, a closer inspection technique using wandering transects and focused searching was applied. Vehicle based searching was also maintained whilst travelling along tracks between targeted areas of habitat.

If populations of known significant flora taxa were identified, representative collections of material were made to confirm identification and provide material for submission to the WAHerbarium. GPS co-ordinates of individual plants of each flora taxon, or clump of individuals where numerous individuals occurred within a few metres of each other, were recorded along with the number of individuals occurring at the location.

Although less emphasis was given to searching for other significant flora taxa outlined in Section 5.1.2, these taxa were kept in mind while traversing the Study Area on the rare chance that they may be present. Locations and numbers of introduced flora were also recorded where located.

An assessment of the significance of the local populations of significant flora recorded in the Compiled Study Area is provided; this has been undertaken by assessing the publicly available information including the taxon's known range within Western Australia; the location of the Compiled Study Area within this range, the number of regional localities and populations from which they are known to occur and the likelihood of further populations being found regionally, based on their habitat preferences and biological characteristics.

3.4.3 Significant Vegetation

As per EPA (2016b), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- Being identified as a Threatened (under both Commonwealth legislation or the W.A. Government TEC endorsement process) or Priority Ecological Community (listed significant vegetation) (Appendix A presents definitions of TECs and PECs as per DBCA (2013));
- Having restricted distribution;
- Degree of historical impact from threatened processes;
- A role as a refuge; and
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

A number of TECs and PECs listed in Western Australia, particularly those in the Pilbara Bioregion, have not been defined by floristic analysis with only broad descriptions often provided. The vegetation of the Study Area was therefore manually compared to such descriptions to determine whether any vegetation may represent a TEC or PEC (DBCA 2018; 2019b). Throughout searching activities the field teams recorded (using GPS location coordinates) any occurrences of vegetation having similarities to that of the Mosquito Creek PEC, including locations where limited species components of the PEC were observed. These locations were reviewed post-field to determine if any specifically matched the PEC.

4. ADEQUACY AND LIMITATIONS OF SURVEY

4.1 Adequacy of Survey

4.1.1 Targeted Sampling and General Assessment

The track logs of survey effort over all three surveys are presented in Figure 6. Targeted flora searching areas within the McPhee Creek Study Area concentrated on potential preferred habitat for flora taxa which were considered likely to occur in that Study Area. As the Targeted survey was undertaken after the initial mapping of vegetation through quadrat assessment, and therefore the field method was designed on relevant data from the Study Area, this method is considered reasonable and robust. Quadrat sampling only was undertaken in the Riparian study area, and therefore it is possible that significant flora taxa occur within this Study Area outside of the areas sampled.

4.1.2 Quadrat Assessment

The Compiled Study Area covers approximately 6429 ha, with 164 quadrats established within it during two surveys. Quadrats were established in all preliminary vegetation patterns discernable by initial aerial photograph interpretation (see Section 3.3), both to adequately sample variation in vegetation throughout the Study Area, and to ensure adequacy of sampling for vascular plant taxa. The density of quadrats established in the Compiled Study Area (one per 39ha; equivalent to one quadrat per 0.4km^2) is an acceptable number given the relatively low diversity of topography and soil types noted in the Compiled Study Area.

A taxon accumulation curve was produced using PC-Ord (V 6) (McCune and Mefford 2011) to determine the adequacy of survey data. Taxon accumulation curves represent a theoretical model of the relationship between sampling intensity and taxon accumulation; when sampling intensity is increased, taxon accumulation is reduced, and a taxon accumulation curve becomes asymptotic.

The taxon accumulation curve for quadrat data from the Compiled Study Area was generated using all native taxa (both annual and perennial) recorded within each quadrat. Taxon accumulation calculations for the Study Area were then undertaken utilising the Chao-2 estimator for species richness (Chao 1987) and compared to the actual number of taxa recorded in the Study Area. This gives some indication as to whether sufficient quadrats have been surveyed to adequately sample the species richness in the Compiled Study Area. As the generation of species accumulation curves includes quadrat data only, and not taxa recorded during targeted searching or opportunistically, the indication of adequacy of survey provided is conservative.

Figure 8 presents the species accumulation curve generated from quadrat data from the Study Area. Using the Chao-2 estimator, the recorded number of taxa within quadrats is equivalent to 87.2 % of the estimated taxon richness in the Study Area. It is therefore considered that the Compiled Study Area was relatively-well sampled with regard to this estimation measure.

200000 205000 210000 215000

7620000 7615000 7610000 7605000 7600000 7595000

Legend

McPhee Creek Compiled Study Area

Quadrats

- Atlas11-65
- Atlas13-17

Track Logs

- Atlas11-47
- Atlas11-65
- Atlas13-06
- Atlas13-17

WOODMAN ENVIRONMENTAL

N

This map should only be used in conjunction with WEC report Atlas19-27-01.

Searching track logs over the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f06.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

6

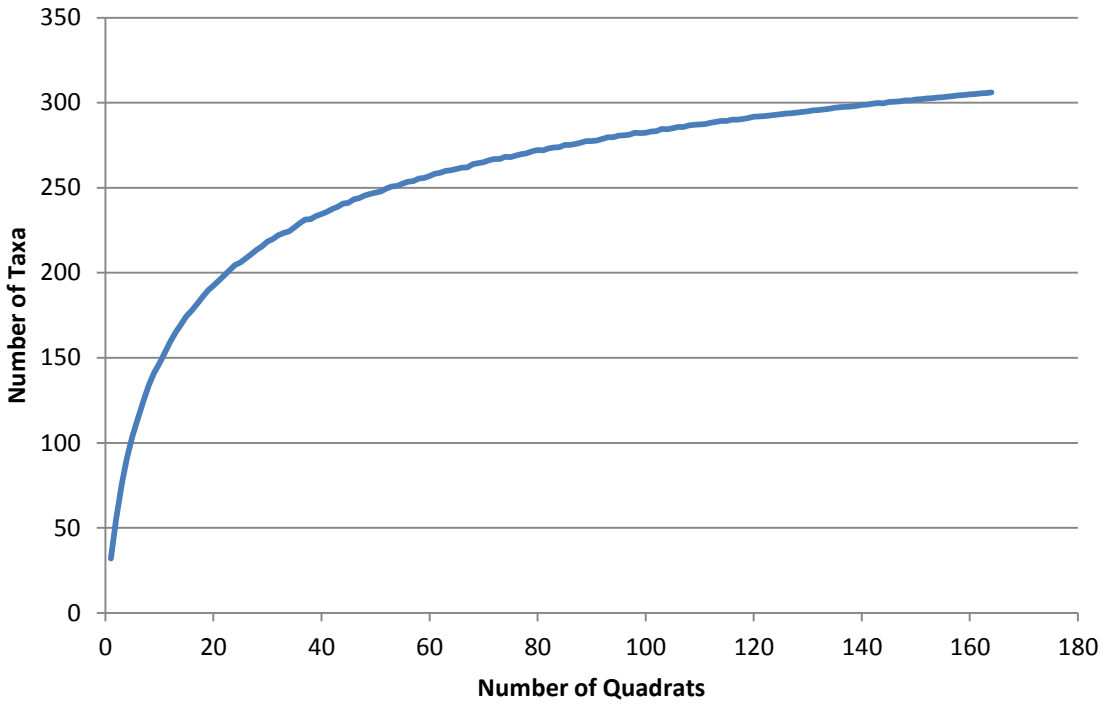


Figure 7: Compiled Study Area Quadrat Data Species Accumulation Curve

It is of interest that the estimated number of native taxa in the Compiled Study Area using Chao-2 was 350; when records of taxa from other sampling sources are included, 373 native taxa (excluding hybrids) were recorded in the Compiled Study Area (see Section 5.2.1), indicating that the Compiled Study Area was relatively well-sampled.

Mueller-Dombois and Ellenberg (1974) suggested that an adequacy cut-off point might be when a 10 % increase in quadrats surveyed results in a 5 % (or less) increase in taxa recorded. This measure was also calculated using all native taxa recorded within each quadrat. The number of quadrats established in the Compiled Study Area satisfies this adequacy measure suggested by Mueller- Dombois and Ellenberg (1974), with the final taxon increase value of 1.49 % recorded following the final 10 % increase in quadrats.

4.2 Limitations of Survey

Table 5 presents the limitations of the flora and vegetation survey of the Study Area in accordance with EPA (2016a).

Table 5: Limitations of the Flora and Vegetation Survey of the Compiled Study Area

Limitation	Limitation of Survey	Comment
Effort and Extent	Potential, minor	Detailed survey was undertaken across entire Compiled Study Area. Multiple quadrats were established in each vegetation pattern identified in the Compiled Study Area. The targeted survey involved transects or opportunistic searching of suitable habitat across the McPhee Creek Study Area only and opportunistic searching within the Riparian study area. All significant taxa identified as potentially occurring in the McPhee Creek Study Area were searched for as part of the targeted survey, with searching targeting non-ironstone areas. However, further searching for significant flora taxa may be required depending on the precise location of future impact areas, including the riparian study area. No constraints prevented appropriate sampling techniques (quadrat establishment, foot transects) being employed. Ease of access to the Compiled Study Area enabled detailed vegetation type and condition mapping to be undertaken throughout the Compiled Study Area via foot and vehicle transects; mapping reliability is therefore considered to be high.
Competency /experience of the team carrying out the survey	No	Project Managers/Field Team Leaders had extensive experience (>5 years) in conducting similar assessments in the Pilbara Bioregion, and in other areas of Western Australia. Personnel conducting plant identifications had > 10 years' experience, including in identifying collections from the Pilbara.
Proportion of flora identified, recorded and/or collected.	No	All vascular groups that were present during the detailed survey were sampled. A high proportion of perennial vascular taxa were recorded based on the intensity and method of survey. A high proportion of annual vascular taxa were recorded based on the intensity and method of survey, and adequate rainfall prior to survey (see timing/weather/season/cycle below). Unknown vascular taxa were collected, with specimens identified at the WA Herbarium. Adequacy of survey measures indicate a high percentage of taxa expected to occur in the Study Area was recorded using Chao-2 estimator (87.2 %), and the number of quadrats established in the Study Area satisfies the criterion suggested by Mueller-Dombois and Ellenberg (1974), with an increase of 1.49 % in species recorded per increase of 10 % of quadrats.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	No	Good contextual information for the Study Area was available prior to the survey. Sources of information used included government databases (DBCA, DoEE), previous unpublished reports and data from the vicinity of the Study Area as well as numerous general sources pertaining to the climate, geomorphology, flora and vegetation of the Pilbara Bioregion (see Section 2).
Timing/weather/season/cycle	No	The surveys were conducted within the appropriate season for survey in the Pilbara Bioregion (6-8 weeks post wet season: March-June (EPA 2016a)). The flowering period was considered by Woodman Environmental to be average at the time of the survey. Rainfall in the four months prior to the 2012 and 2013 surveys was just above average for that period. This period is considered to be the most important in terms of influencing the quality of a given flowering season and general vegetation condition in the Pilbara however these climatic conditions were not detrimental and did not affect the outcomes of the survey. All taxa were identifiable.

Limitation	Limitation of Survey	Comment
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	No	A proportion of the Compiled Study Area was relatively recently burnt (within the last three to four years), however this did not affect the results of the survey with the vegetation able to be confidently assigned to a VT, and taxa mature enough to be easily identified. Sufficient time had passed in which post-fire coloniser taxa had declined. The remainder of the Study Area had not been significantly affected by fire in recent years.
Remoteness and/or access problems	No	There were no impediments to access within the Study Area, with numerous tracks present to and within all parts of the Study Area. All areas were accessible on foot from adjacent tracks.

5. RESULTS

5.1 Desktop Study

5.1.1 Other Local Flora and Vegetation Surveys

Table 6 presents a summary of the information reported through flora and vegetation surveys which were conducted prior to the completion of the surveys by Woodman in 2012 and 2013 (prior to field surveys at McPhee Creek). Table 7 presents a summary of the flora and vegetation surveys which have been conducted post 2013 within the vicinity of the Compiled Study Area. Vegetation and flora surveys which have been undertaken further afield of the Compiled Study Area (for example, surveys at Miralga Creek and Abydos) have not been included in Tables 6 or 7 due to their distance from the Compiled Study Area. Table 7 also includes details from the two publicly available flora and vegetation surveys conducted within 120km of the Compiled Study Area accessible through the IBSA portal; a third report (prepared by Ecologia for Fortescue Metals Group) was not available for access and therefore no information has been presented.

Figure 8 presents a layout of the study areas associated with flora and vegetation surveys undertaken by Woodman Environmental on behalf of Atlas Iron, in comparison to the location of the Compiled Study Area. Note that the Compiled Study Area is located on the eastern extent of survey effort, and therefore potentially represents a change in the vegetation and flora present in comparison to the other surveys due to its location, and presence of potentially different soil and landscape types.

5.1.1 Floral Diversity

A total of 388 discrete vascular flora taxa and nine hybrids were recorded in the Compiled Study Area during the surveys by Woodman Environmental, including 373 native taxa and 15 introduced taxa. These taxa represent 51 families and 165 genera. The most well-represented families were Fabaceae (75 taxa), Poaceae (62 taxa) and Malvaceae (36 taxa).

Overall the Compiled Study Area is considered to be of moderate floristic diversity. The species richness of the Compiled Study Area was higher than that recorded during previous surveys in the vicinity of the McPhee Creek compiled study area (for example, surveys for the Spinifex Ridge Molybdenum Project (80 km north of the Study Area) and for the Nullagine Project Area for Millennium Minerals (40 km south-east of the Study Area); Table 6). The Spinifex Ridge Molybdenum Project survey was undertaken in July, it is therefore possible that some ephemeral and geophytic taxa potentially present may not have been recorded, hence the lower diversity. Good rainfall leading up to the May 2012 and April/May 2013 surveys of the Compiled Study Area meant that a larger number of species were possibly able to be surveyed.

Table 6: Summary of Flora and Vegetation Surveys Conducted in the Vicinity of the Compiled Study Area prior to 2013

Project	Location	Study	Parameters of Survey	Number of Taxa	Vegetation	Significant Flora Taxa	Introduced Taxa
Spinifex Ridge Molybdenum Project Moly Mines Ltd	80 km north of study area	Outback Ecology (2006)	62 floristic survey sites	188 taxa; 101 genera; 42 families	24 Vegetation Types described No TECs or PECs	None recorded	8 taxa: **Aerva javanica*; **Cenchrus ciliaris*; **Citrullus colocynthis*; **Chloris virgata*; **Datura leichhardtii;* **Echinochloa colona;* ** Malvastrum americanum;* **Passiflora foetida*
Nullagine Project Area Millennium Minerals	40 km south-east of study area	Mattiske Consulting Pty Ltd (2011)	213 sites	259 taxa; 102 genera; 39 families	17 plant communities No TECs or PECs	4 taxa: *Lepidium catapycnon* (T) *Acacia aphanoclada* (P1) *Ptilotus mollis* (P4) *Acacia fecunda* (P3) *Acacia glaucocaesia* (no longer a listed Priority flora taxon)	7 taxa: **Argemone ochroleuca* subsp. *ochroleuca;* **Cenchrus ciliaris;* **Cenchrus setiger;* **Gomphrena celosioides;* **Pennisetum pedicellatum;* **Sigesbeckia orientalis;* **Vachellia farnesiana*
Turner River Hub Project Atlas Iron Ltd	80 km west of study area	Woodman Environmental (2011b)	646 quadrats established	403 taxa; 171 genera; 62 families	10 floristic community types and 3 mosaics in Mt Webber section of project. No TECs or PECs	2 taxa in Mt Webber section of project: *Gomphrena leptophylla* (P3) *Ptilotus mollis* (P4)	3 taxa in Mt Webber section of project: **Aerva javanica; *Cenchrus ?ciliaris;* **Cynodon dactylon*
Mt Webber DSO Project Atlas Iron Ltd	80 km west of Study Area	Woodman Environmental (2012) - mining area and Public Road Upgrade (PRU)	117 quadrats established in mining area (July and August 2010); 87 flora survey quadrats established in PRU (April 2012)	354 taxa; 139 genera; 50 families	16 VTs; No TECs or PECs identified; No VTs considered of regional conservation significance	6 priority taxa: *Bulbostylis burbidgeae* (P4); *Gomphrena leptophylla* (P3); *Gymnanthera cunninghamii* (P3); *Heliotropium murinum* (P3); *Ptilotus mollis* (P4); *Rothia indica* subsp. *australis* (P3)	8 taxa: **Aerva javanica*; **Cenchrus ciliaris*; **Chloris barbata*; **Citrullus amarus*; **Cynodon dactylon*; **Flaveria trinervia*; **Malvastrum americanum*; **Vachellia farnesiana*
		Woodman Environmental (2013b) - PRU supplementary survey	21 quadrats established (April 2013)	Additional 12 taxa to Woodman Environmental (2012)			

Table 7: Summary of Flora and Vegetation Surveys Conducted in the Vicinity of the Compiled Study Area since 2013

Project	Location	Study	Parameters of Survey	Number of Taxa	Vegetation	Significant Flora Taxa	Introduced Taxa
McPhee Creek Rail Project Atlas Iron Ltd Woodman Environmental	-	Woodman Environmental (2014c) - Eastern Corridor (Yandeyarra to Mt Webber and McPhee Creek)	302 quadrats (June/July 2013)	508 taxa; 7 hybrids; 193 genera; 62 families	22 vegetation types; No TECs or PECs identified; 7 VTs were ranked higher local significance; No VTs considered of regional conservation significance	14 taxa: *Acacia cyperophylla* var. *omearana* (P1); *Acacia levata* (P3); *Acacia* sp. Nullagine (B.R. Maslin 4955) (P1); *Acacia* sp. indet. (potentially undescribed); *Bulbostylis burbidgeae* (P4); *Cochlospermum macnamarae* (P1); *Eragrostis crateriformis* (P3); *Goodenia nuda* (P4); *Gymnanthera cunninghamii* (P3); *Heliotropium murinum* (P3); *Nicotiana umbratica* (P3); *Phyllanthus hebecarpus* (P3); *Ptilotus mollis* (P4); *Rothia indica* subsp. *australis* (P3)	19 taxa: **Argemone ochroleuca*; **Bidens bipinnata*; **Cenchrus ciliaris*; **Cenchrus setiger*; **Chloris barbata*; **Chloris virgata*; **Citrullus amarus*; **Cynodon dactylon*; **Digitaria ciliaris*; **Echinochloa colona*; **Flaveria trinervia*; **Malvastrum americanum*; **Solanum nigrum*; **Sonchus oleraceus*; **Trianthema portulacastrum*; **Tribulus terrestris*; **Vachellia farnesiana*
McPhee Creek Rail Spur Project Atlas Iron Pty Ltd	-	Woodman Environmental (2014d) – Rail spur linking Eastern Corridor to a third party rail line	188 quadrats (May/June 2014)	364 taxa; 6 hybrids; 159 genera; 54 families	18 vegetation types; No TECs or PECs identified; 6 VTs considered of local significance; 3 VTs considered of potential regional conservation significance (VT 7, 8, 23)	*Abutilon* aff. *hannii* (potentially undescribed); *Bulbostylis burbidgeae* (P4); *Cochlospermum macnamarae* (P1); *Eragrostis crateriformis* (P3); *Gymnanthera cunninghamii* (P3); *Heliotropium murinum* (P3); *Nicotiana umbratica* (P3); *Rhynchosia bungarensis* (P4); *Rostellularia adscendens* var. *latifolia* (P3); *Rothia indica* subsp. *australis* (P3)	**Aerva javanica*; **Argemone ochroleuca*; **Bidens bipinnata*; **Cenchrus ciliaris*; **Citrullus amarus*; **Cynodon dactylon*; **Flaveria trinervia*; **Malvastrum americanum*; **Parkinsonia aculeata*; **Sonchus oleraceus*; **Vachellia farnesiana*
Corunna Downs Project Atlas Iron Pty Ltd	20 km west of Study Area	Extended Corunna Downs Study Area Woodman Environmental (2016) – Level 2	357 quadrats (Mar/Apr, May 2014; May 2016)	411 taxa; 2 hybrids; 177 genera; 63 families	15 vegetation types; No TECs or PECs identified; 4 VTs considered of potential regional	16 taxa: *Abutilon* aff. *hannii* (potentially undescribed); *Acacia levata* (P3); *Acrostichum speciosum*	18 taxa: **Aerva javanica*; *?*Amaranthus viridis*; **Argemone ochroleuca*; **Calotropis procera*;

Project	Location	Study	Parameters of Survey	Number of Taxa	Vegetation	Significant Flora Taxa	Introduced Taxa
		Flora and Vegetation Assessment Corunna Downs Study Area Woodman Environmental (2014e) – Level 2 Flora and Vegetation Assessment			conservation significance (VT 3, 6, 7, 8)	(significantly disjunct record); *Cochlospermum macnamarae* (P1); *Eragrostis crateriformis* (P3); *Eriocaulon pusillum* (significantly disjunct record); *Heliotropium murinum* (P3); *Nicotiana umbratica* (P3); *Oldenlandia* sp. (potentially undescribed); *Portulaca ?digyna* (potentially undescribed or significantly disjunct record); *Ptilotus mollis* (P4); *Rostellularia adscendens var. latifolia* (P3); *Rothia indica subsp. australis* (P3); *Schoenus* sp. Marble Bar (D. Coultas & S. Coultas DCSC-Opp 07) (P1); *Stylidium weeliwolli* (P3); *Swainsona thompsoniana* (P3)	**Cenchrus ciliaris*; **Cenchrus setiger*; **Chloris barbata*; **Cynodon dactylon*; **Echinochloa colona*; **Flaveria trinervia*; **Malvastrum americanum*; **Passiflora foetida* var. *hispida*; **Portulaca pilosa*; **Setaria verticillata*; **Solanum nigrum*; **Sonchus oleraceus*; **Tribulus terrestris*; **Vachellia farnesiana*
Newman-Roy Hill Transmission Line Survey	80 km south of study area	Ecoscape (2013)	15 quadrats 54 releves	292 Taxa 38 families 110 genera	17 VTs No TECs/PECs	No Threatened taxa Four Priority Taxa: *Eremophila pilosa* (P1) *Eremophila youngii* subsp. *lepidota* (P4) *Rhagodia* sp. Hamersley (P3) *Themenda* sp. Hamersley (P3)	6 Taxa: *Aerva javanica* *Bidens bipinnata* *Cenchrus ciliaris* *Heliotropium europaeum* *Malvastrum americanum* *Vachellia farnesiana*
Cundaline Northern Ridge	100 km north of study area	Onshore Environmental (2013)	8 quadrats 47 releves	165 Taxa 38 Families 85 Genera	13 VTs No TECs/PECs	No Threatened taxa or Priority Taxa	7 taxa: *Aerva javanica* *Cenchrus ciliaris* *Cenchrus setiger* *Cenchrus setaceus* *Chloris barbata* *Citrullus colocynthis* *Jatropha gossypiifolia*

20000 70000 120000 170000 220000

7750000 7700000 7650000 7600000 7550000

SHELLBOROUGH
FINUCANE
PORT HEDLAND
GOLDSWORTHY
SHAY GAP
BAMBOO
MARBLE BAR
NULLAGINE

Legend

- McPhee Creek Compiled Study Area

Other Atlas Projects

- Abydos 2011
- Corunna Downs Extension
- East West Railway
- Hercules
- Miralga Creek
- Mount Dove
- Mt Webber Camp/Haul Road
- Mt Webber PRU Expansion
- Railway Extension
- Rook East
- Turner River Hub

20000 70000 120000 170000 220000

WOODMAN ENVIRONMENTAL

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Extent of Regional Vegetation Surveys conducted in the Vicinity of the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f08.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

8

5.1.2 Significant Flora

The results of the DBCA WA Herbarium specimen database and TPFL database search returned 24 significant vascular flora taxa from within 50 km of the Study Area, as presented in Table 8. All taxa returned from the search were Priority (P) flora taxa (DBCA 2019d). Appendix B presents conservation codes for Western Australia flora (DBCA 2019a).

A search of *NatureMap* was also undertaken (DBCA 2007-) to check for any recently added records and confirm the records returned from the DBCA WA Herbarium specimen database and TPFL database search. 21 taxa were returned from the search (see Table 8), all of which were within the DCBA database searches.

The search of the DoEE SPRAT database (DoEE 2019) with regard to MNES listed under the EPBC Act did not identify any flora taxa listed as Threatened Species, or habitat for such taxa, as occurring in the search area. The results of the DoEE database search are presented in Appendix C.

A list of significant flora taxa that are known from within or in the vicinity of the Study Area is presented in Table 8. This list has been compiled from the results of searches of the DBCA Threatened Flora Databases and the results of relevant local surveys as outlined in Section 3.1. Those taxa which were identified in local surveys however are unlikely to occur (i.e. the recorded at significant distance from the Compiled Study Area) were not included.

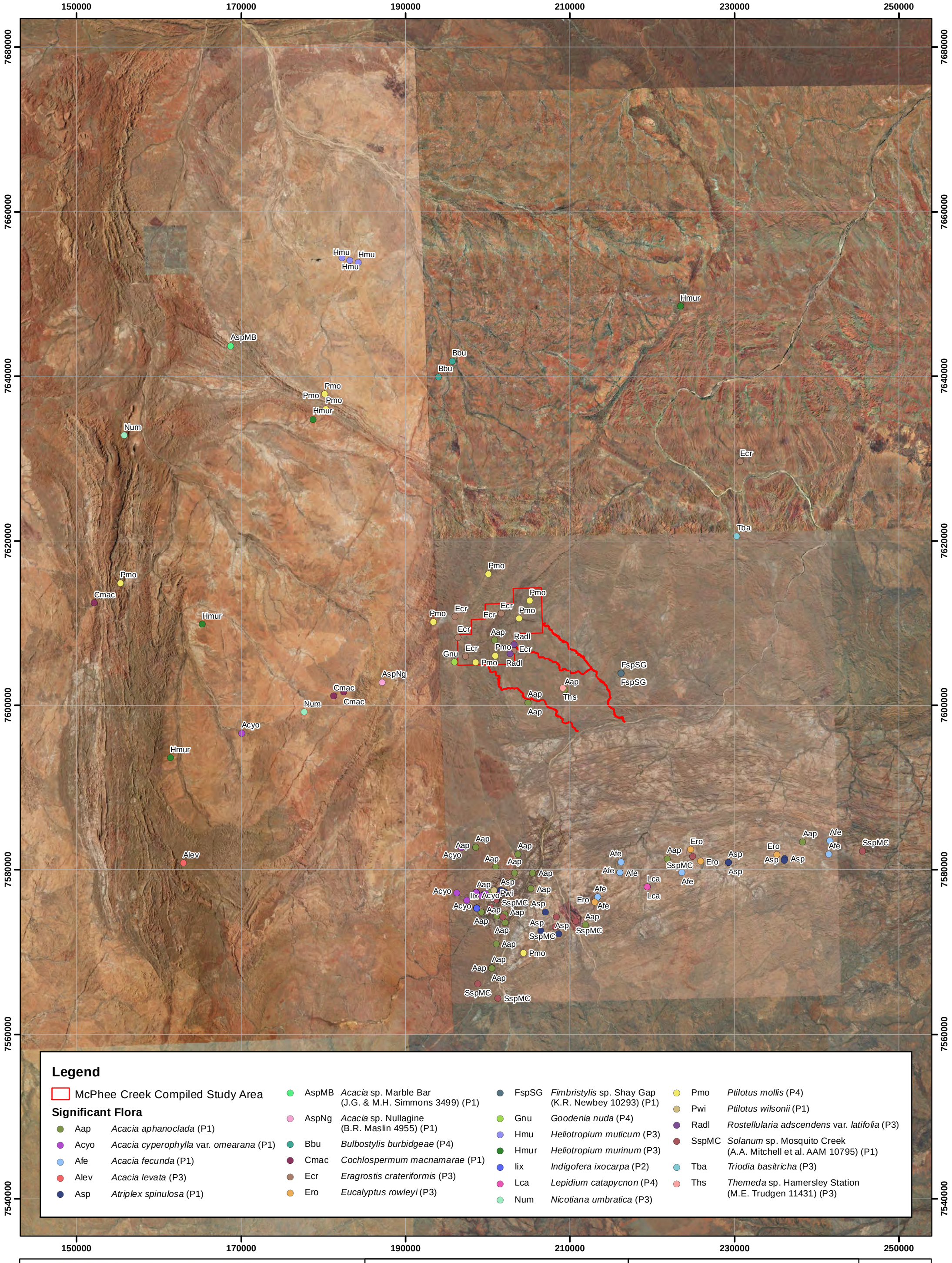
A total of 27 significant flora taxa are known from within the vicinity of the Compiled Study Area, all are listed as Priority taxa. No listed Threatened Taxa were identified during the desktop study. The locations associated with the DBCA significant flora database searches are presented on Figure 10. Please note these records also contain locations from the Compiled Study Area recorded by Woodman Environmental reported to the DBCA as part of the requirements for reporting.

There are several key differences in the extent of returned significant flora taxa from the desktop reviews conducted in Woodman Environmental (2011a; 2014a) in comparison to the current data:

- Three Priority flora taxa which were returned from the original McPhee Creek desktop review (Woodman Environmental 2011a; 2014a) were not returned in the current database searches as presented in Table 8. As all these taxa were originally returned through the TPL listing for the Pilbara, they are not necessarily returned from within the search area. It is considered unlikely that any of these taxa would occur in the Compiled Study Area, and therefore are not discussed further in this report:
    - *Goodenia* sp. East Pilbara (AA Mitchell PRP 727) (P3) is located 75km south of the Compiled Study Area;
    - *Pityrodia* sp. Marble Bar (G. Woodman &D. Coultas GWDC Opp4) (T) is located 45km west of Marble Bar; and
    - *Tribulus minutus* (P1) is known from one location approximately 85km to the north-east of the Compiled Study Area.
- A total of 9 new significant taxa were returned from the current desktop review (including current DBCA database searches) in comparison to the desktop review

conducted prior to the survey of the McPhee Creek study area (Woodman Environmental 2011a; 2014a) (highlighted in green in Table 8).

- A total of 8 new significant taxa were returned from the current desktop review (including current DBCA database searches) in comparison desktop review conducted prior to the survey of the Riparian survey area (Woodman Environmental 2014b) (highlighted in green in Table 8).



WOODMAN ENVIRONMENTAL

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Significant Flora Returned from the DBCA Database Searches

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Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure 9

Table 8: Significant Flora Taxa Known from the Vicinity of the Study Area

Taxon	Status	Source[#]	Flowering Period (WA Herbarium 1998-)	Habit and Habitat (WA Herbarium 1998-)	Original Desktop Review	
					Woodman Environmental 2014a	Woodman Environmental 2014b
Acacia aphanoclada	P1	TPFL, WA Herb, NM, Other	Aug - Oct	Slender, wispy shrub, 1.7–5 m high. Skeletal stony soils. Rocky hills, ridges and rises Known from within the Compiled Study Area (Woodman Environmental); other nearest known record is 20km to the south. The range is restricted; the Compiled Study Area is at the northern extent of the range.	*	*
Acacia cyperophylla var. *omearana*	P1	TPFL, WA Herb, NM	Mar - Apr	Tree, 4–10 m high, 'minni-ritchi' bark. Stony and gritty alluvium; 'dry' stony/skeletal sandy drainage lines. Nearest known record is approximately 20km south of the Compiled Study Area. A total of 19 records, forming four localities, with a range of 130km; the Compiled Study Area is not within the known range.	*	*
Acacia fecunda	P1	TPFL, WA Herb, NM, Other	May or Aug	Erect, obconic shrub, to 3 m high, bark grey, smooth becoming yellow-brown on upper branches; phyllodes more or less sub-glaucous with a slight sheen; inflorescence of spikes. Quartzite gibbers over grey-red skeletal soil. Along shallow creeks and drainage lines, hills, road verges. Nearest known record is approximately 20km south-east of the Compiled Study Area. Most records are located in the Mosquito Land System; not a widespread taxon; the Compiled Study Area is not in the known range.	*	*
Acacia levata	P3	WA Herb	May	Spreading, multi-stemmed shrub, 1-3 m high, to 5 m wide. Sand or sandy loam over granite. Hillslopes. Nearest known record approximately 40km to the west of the Compiled Study Area; 25 records within 8 localities known; Compiled Study Area not in the known range.	*	*
Acacia sp. Marble Bar (J.G. & M.H. Simmons 3499)	P1	WA Herb	Sep	Shrub, inflorescence in spikes to 30mm long (WA Herbarium 1998-). Dry watercourse amongst low rocky hills (Maslin *et al.* 2010) Nearest known record approximately 40km to the north-west of the Compiled Study Area; only a single record known.	*	*
Acacia sp. Nullagine (B.R. Maslin 4955)	P1	WA Herb, NM	Unknown	Erect, spindly shrub, to 3 m high, bark 'minni-ritchi', grey above, red underneath. Rocky clay. Low-lying areas between rocky hills One single record approximately 9km west of the Compiled Study Area.	*	*

Taxon	Status	Source[#]	Flowering Period (WA Herbarium 1998-)	Habit and Habitat (WA Herbarium 1998-)	Original Desktop Review	
					Woodman Environmental 2014a	Woodman Environmental 2014b
Atriplex spinulosa	P1	TPFL, WA Herb, NM	Unknown	Monoeciouos, erect, rounded annual, herb, ca 0.2 m high. Grey or brown silty clay loam on slopes Nearest known record approximately 25km south of the Compiled Study Area. Most known records in the Mosquito Land System; not a widespread taxon, the Compiled Study Area is not located within the range.	*	*
Bulbostylis burbidgeae	P4	WA Herb, NM, Other	Mar, Jun - Aug	Tufted, erect to spreading annual, grass-like or herb (sedge), 0.03-0.25 m high. Granitic soils. Granite outcrops, cliff bases One known location occurring immediately west of the Compiled Study Area (Pilbara Plant Survey (site NW06). Compiled Study Area on the eastern edge of a wide known range (450km).	*	*
Cochlospermum macnamarae	P1	WA Herb, NM	May	Spreading, multi-stemmed shrub to 2 m high. Granite outcrops. Nearest known record is approximately 14km to the west of the Compiled Study Area (Woodman Environmental specien); known from approximately five localities over a distance of 100km; the Compiled Study Area is not in the known range.		
Eragrostis crateriformis	P3	WA Herb, NM	Jan - May or Jul	Annual grass to 0.4 m high. Seasonally wet areas, flats. Recorded in the Compiled Study Area (Woodman Environmental); the study area is within the known, extensive range of this taxon.		
Eucalyptus rowleyi	P3	WA Herb, NM	Unknown	Mallee, 3-5 m high, white flowers. Red sandy loams on plains and very minor and broad flood-out plains and creeklines. Nearest records are approximately 35km to the south south-east of the Compiled Study Area; the study area is outside of the known range of this taxon, which is known from approximately 11 localities, and has a moderate range known from 31 records.		*
Fimbristylis sp. Shay Gap (K.R. Newbey 10293)	P1	TPFL, WA Herb, NM	Jun - Jul	Tufted annual, grass-like or herb (sedge), 0.12-0.15 m high, inflorescence of 3-many spikelets; glumes 2-2.5 mm long; stamens 3, anthers 0.5-0.6 mm long. Sandy soil. Drainage line. Known from two records only; one of the records is 3km east of the riparian study area. The notes to this collection state it was taken from the edge of a small basalt pool in a creekline.	*	*

Taxon	Status	Source[#]	Flowering Period (WA Herbarium 1998-)	Habit and Habitat (WA Herbarium 1998-)	Original Desktop Review	
					Woodman Environmental 2014a	Woodman Environmental 2014b
Gomphrena leptophylla	P3	Other	Mar - Sep	Prostrate or erect to spreading annual, herb, to 0.15 m high. Sand, sandy to clayey loam, granite, quartzite. Open flats, sandy creek beds, edges salt pans & marshes, stony hillsides. Nearest known record is approximately 75km to the west of the Compiled Study Area; the study area is on the edge of the known, extensive range of this taxon.	*	*
Goodenia nuda	P4	WA Herb, NM	Apr - Aug	Erect, perennial herb to 0.5 m high. Red-brown sandy loam in seasonally moist depressions, claypans, edge of drainage lines, floodplains. Three collections taken from proximity to the western boundary of the Compiled Study Area (record by Woodman Environmental), collected from an open depressions on brown sandy loam with granite. However, these collections are from outside of the usual (although extensive) range of this taxon; and identification notes concur that the specimens were not a perfect match for this taxon.		
Gymnanthera cunninghamii	P3	Other	Jan - Dec	Erect shrub, 1-2 m high. Sandy soils. A relatively wide-ranging taxon, however the nearest record is located approximately 60km west of the Compiled Study Area; the study area is outside of the known range of this taxon.	*	*
Heliotropium murinum	P3	WA Herb, NM, Other	May, Sep	Short-lived perennial, herb to 0.4 m high. This taxon is a fire responder. Red sand plains, stony granitic plains. Known from 17 records, the Compiled Study Area is approximately 30km south-east of the nearest record and is outside of the known range.	*	*
Heliotropium muticum	P3	WA Herb	May, Jul, Aug, Oct, Nov	Ascending to spreading perennial herb to 0.3 m high. This taxon is a fire responder. Sandy plains. This taxon has a wide range, however the nearest records to the Compiled Study Area are located approximately 40km to the north (near Mable Bar); these records are also an outlier, with the majority of records located at least 80km to the west of the Compiled Study Area.		

Taxon	Status	Source[#]	Flowering Period (WA Herbarium 1998-)	Habit and Habitat (WA Herbarium 1998-)	Original Desktop Review	
					Woodman Environmental 2014a	Woodman Environmental 2014b
Indigofera ixocarpa	P2	TPFL, WA Herb, NM	May	Shrub, to 1 m high. Skeletal red soils over massive ironstone. The nearest records are located approximately 30km south of the Compiled Study Area; however, these are outliers to the main range, located 200km to the east of this record. The nearest records are located on the bed of a small drainage line, near a pool.	*	*
Lepidium catapycnon	P4	TPFL, WA Herb, NM, Other	Oct	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag. Skeletal soils. Hillsides. The nearest known records are located approximately 25km south south-east of the Compiled Study Area; these are outliers to the known (extensive) range of this taxon, located approximately 120km to the north-east of the main range.	*	*
Nicotiana umbratica	P3	WA Herb, NM	Apr - Jun	Erect, short-lived annual or perennial, herb, 0.3-0.7 m high. Shallow soils. Rocky outcrops. The Compiled Study Area is located approximately 25km to the east of the nearest known record; this taxon is known from approximately 14 locations, over 180km; the Compiled Study Area is outside of the known range.	*	*
Ptilotus mollis	P4	WA Herb, NM, Other	May, Sep	Compact, perennial shrub, to 0.5 m high, soft grey foliage. Stony hills and screes. Known from within the Compiled Study Area (Woodman Environmental); the study area is located within the known extent of the range..	*	*
Ptilotus wilsonii	P1	WA Herb, NM	Oct	Shrub, ca 0.5 m high. Stony gravelly soils. Rocky hills. The nearest record is located approximately 25km south of the Compiled Study Area; the other two records known are 200km further to the west than that record. The Compiled Study Area is not within the known range of this taxon.		
Rostellularia adscendens var. *latifolia*	P3	WA Herb, NM	Apr - May	Herb or shrub to 0.3 m high. Creeks, rocky hills. Known from within the Compiled Study Area (Woodman Environmental). This taxon has a wide range, and the study area is not on the edge of the range.		

Taxon	Status	Source[#]	Flowering Period (WA Herbarium 1998-)	Habit and Habitat (WA Herbarium 1998-)	Original Desktop Review	
					Woodman Environmental 2014a	Woodman Environmental 2014b
Rothia indica subsp. *australis*	P3	Other	Apr - Aug	Prostrate annual, herb, to 0.3 m high, densely covered in spreading hairs. Sandy soils. Sandhills and sandy flats. The nearest records are known approximately 70km west of the Compiled Study Area; 13 localities of this taxon are known in the area, over a range of approximately 170km; two other disjunct locations are known (both >400km to the east and north-east).	*	*
Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795)	P1	WA Herb, NM	Unknown	Upright-spreading, open, perennial, woody shrub to 1 m high. Leaves dull pale grey-green; corolla dull darkish purple. Light clay. Plain, creeks and muddy flats The range of this taxon is known from 10 records, all located in the Mosquito Land System. The nearest record is located approximately 20km south of the Compiled Study Area; the study area is not located within the known range.		
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	WA Herb, NM	Aug	Tussocky perennial, grass, 0.9-1.8 m high. Red clay in claypans, plains This taxon has a wide range (approximately 430km), from a total of 45 records. One record is in relative proximity to the Riparian study area; this record however is itself an outlier from the main range. The Compiled Study Area is located on the edge of the known main range and is within the range including outlier locations.	*	*
Triodia basitricha	P3	WA Herb, NM	Jan - Mar	Tussock-forming perennial, 30–40 cm high. Slopes or crests of rocky hills. One record of this taxon is located 20km to the east north-east of the Compiled Study Area; that record is the eastern extent of the known range of the taxon, which spans over 400km, known from 24 records. The Compiled Study Area is located on the eastern extent of the range.		

[#] Note: Sources of records are:

- TPFL – DBCA Threatened and Priority Flora Database
- WA Herb – WA Herbarium specimen database
- NM – Nature Map search (DBCA 2007-)
- Other – Local surveys listed in Table 6

5.1.3 Introduced Flora

The search of the DoEE SPRAT database with regard to MNES listed under the EPBC Act identified two significant invasive introduced flora taxa or habitat for the taxa, may occur within the Study Area; **Cenchrus ciliaris* and **Parkinsonia aculeata* (DoEE 2019).

DBCA prioritises weeds in each region, based on their invasiveness, ecological impact, potential and current distribution and feasibility of control based on the *Weed Prioritisation Process* (DBCA 2013b). Table 9 presents the ecological impact and invasiveness ratings for each introduced taxon for the Pilbara Region (DBCA 2014).

A list of introduced flora taxa known from the vicinity of the Compiled Study Area is presented in Table 9. This has been compiled from WA Herbarium specimen data and from local flora surveys (Section 5.1.1). A total of 26 introduced taxa are known to occur in the vicinity of the Compiled Study Area. Ten of these introduced taxa are ranked as having High ecological impact for the DBCA Pilbara Region (DBCA 2014).

Table 9: Introduced Flora Taxa Known from the Vicinity of the Compiled Study Area

Taxon	Common Name (WA Herbarium 1998-)	Source[#]	Ecological Impact (DBCA 2014)	Invasiveness (DBCA 2014)
Aerva javanica	Kapok	DBCA; Other	High	Rapid
Argemone ochroleuca subsp. *ochroleuca*	Mexican Poppy	DBCA; Other	Unknown	Rapid
Bidens bipinnata	Bipinnate Beggartick	DBCA	Unknown	Rapid
Cenchrus ciliaris	Buffel Grass	DBCA; Other	High	Rapid
Cenchrus setiger	Birdwood Grass	Other	High	Rapid
Chloris barbata	Purple Top Chloris	Other	High	Rapid
Chloris virgata	Feathertop Rhodes Grass	Other	High	Rapid
Citrullus colocynthis	Colocynth	Other	Unknown	Moderate
Citrullus amarus	Pie Melon	Other	Unknown	Moderate
Cucumis melo	Ulcardo Melon	Other	Unknown	Moderate
Cynodon dactylon	Couch	DBCA; Other	High	Rapid
Datura leichhardtii	Native Thornapple	Other	Unknown	Unknown
Echinochloa colona	Awnless Barnyard Grass	DCBA; Other	High	Rapid
Eragrostis amabilis	-	DBCA	-	-
Eragrostis pilosa	-	Other	Unknown	Unknown
Flaveria trinervia	Speedy Weed	DBCA; Other	-	-
Gomphrena celosioides	Gomphrena Weed	Other	Low	Unknown
Malvastrum americanum	Spiked Malvastrum	Other	High	Rapid
Melochia pyramidata	-	DBCA; Other	-	-
Passiflora foetida	Stinking Passion Flower	Other	High	Rapid
Pennisetum pedicellatum	-	Other	-	-
Setaria verticillata	Whorled Pigeon Grass	Other		
Sigesbeckia orientalis	Indian Weed	Other	Unknown	Rapid
Sonchus oleraceus	Common Sowthistle	DBCA	Low	Rapid
Trianthema portulacastrum	Giant Pigweed	DBCA; Other	-	-
Vachellia farnesiana	Mimosa Bush	DBCA; Other	High	Rapid

Note: Sources of records are DBCA - WA Herbarium specimen database; Other – Local surveys listed in Table 6

5.1.4 Regional Vegetation

The Study Area is located in the Pilbara IBRA region, specifically within the Chichester IBRA Subregion (Commonwealth of Australia 2012). The vegetation of the subregion is comprised of shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands on plains, and *Eucalyptus leucophloia* tree steppes on the ranges (Kendrick and McKenzie 2001).

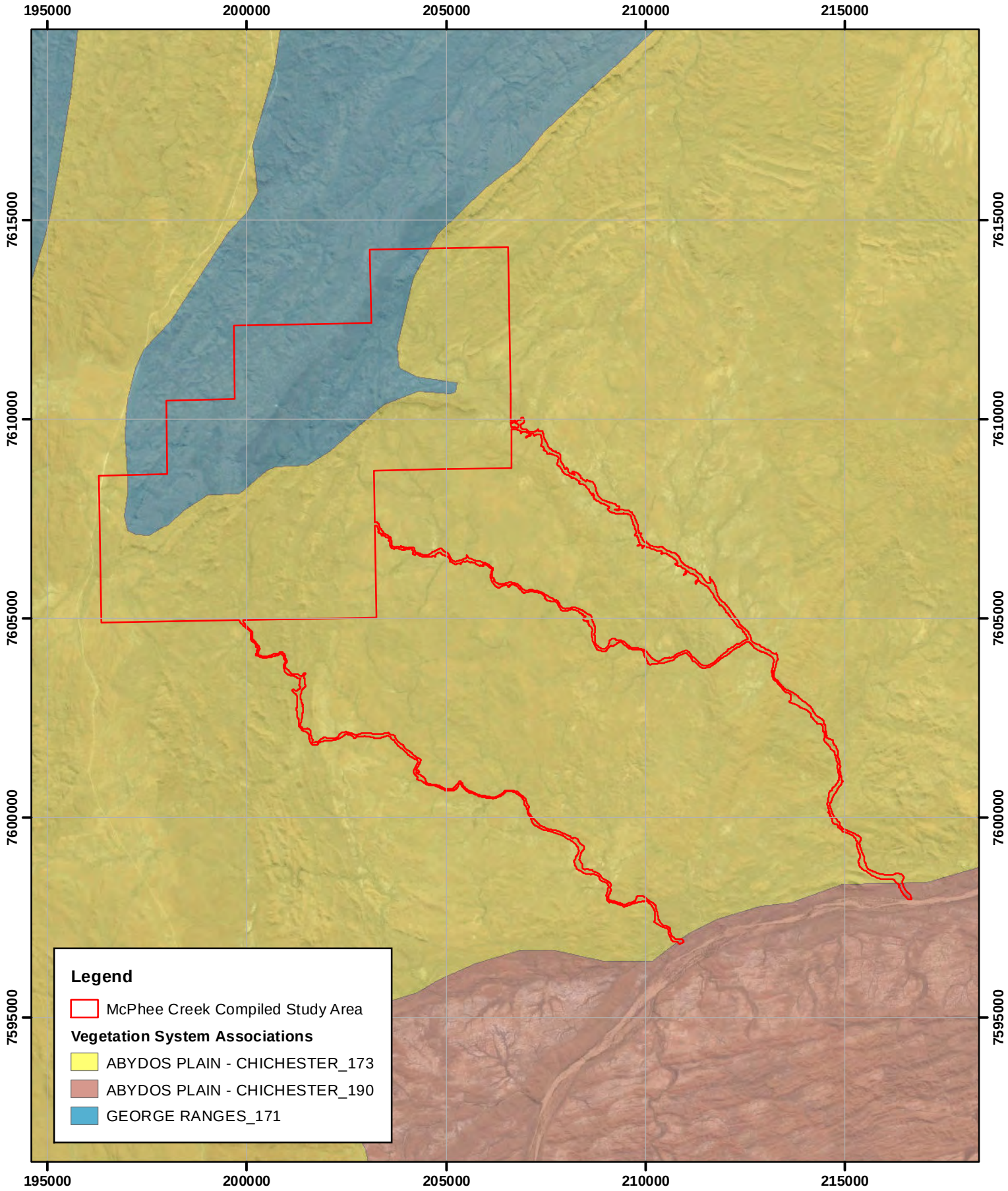
Beard (1975) mapped the vegetation of the Pilbara region based on physiographic units, at a scale of 1:1,000,000. As previously mentioned, the Study Area traverses the Abydos Plain and George Ranges physiographic regions within the Pilbara region.

As described in section 2.3, the Abydos Plain is comprised mainly of low alluvial plains, low stony hills, pediplains and some low granitic outcrops. The vegetation is characterised by four broad associations: Shrub steppe, Dwarf-shrub steppe, Grass plains and the Coastal Complex. Of these, shrub steppe is the only association relevant to the Study Area. Shrub steppe is the main community of the granite plain, which is dominated by the *Acacia pyrifolia-Triodia epactia* (formerly *T. pungens*) association, with hummock grasses dotted with widely spaced shrubs. The plain is broken by stony rises and hills with small ranges, with *T. epactia* usually replaced by *T. wiseana, T. longiceps* or *T. angusta*, with scattered shrubs. Larger ranges tend to possess mainly Triodia, with only a few scattered shrubs and trees. Major creeks and rivers are wooded with *Eucalyptus camaldulensis* and *Melaleuca argentea* (formerly *M. leucadendron*) (Beard 1975).

The George Ranges is a rough, steep and abrupt range; the vegetation consists of tree steppe on the high rocky parts, often with only a sparse occurrence of trees, dominated by *Eucalyptus leucophloia* (formerly *E. brevifolia*) and hummock grasses of *Triodia epactia* and *T. brizoides*. The lower slopes are generally comprised of shrub steppe of *Acacia bivenosa* and *T. epactia*, while the valleys contain *A. pyrifolia* (Beard 1975).

Shepherd *et al.* (2002) mapped and described vegetation system associations (VSA) in the Chichester IBRA subregion utilising mapping undertaken by Beard (1975). Vegetation system associations were described at a scale of 1:250,000. Three VSAs are mapped in the Compiled Study Area as presented on Figure 10. The majority of the Compiled Study Area is mapped on the Abydos Plain-Chichester_173 VSA, including the southern and eastern extents of the McPhee Creek Study Area, and the majority of the Riparian Study Area. In the Compiled Study Area, this VSA is predominantly associated with the Rocklea Land System (van Vreeswyk *et al.* 2004; section 2.3).

The Abydos Plain-Chichester_190 VSA is mapped only on the extreme downstream extents of the Riparian Study Area; this VSA is associated mainly with the Mosquito Land System (van Vreeswyk *et al.* 2004; section 2.3). The George Ranges_171 occurs on the north-western extent of the Compiled Study Area; this VSA is associated with the Capricorn, Taylor and Robe Land Systems as mapped in the Compiled Study Area (van Vreeswyk *et al.* 2004; section 2.3).



Vegetation System Associations of the McPhee Creek Compiled Study Area	Author: Leah Firth	N
	WEC Ref: Atlas19-27-01	
WOODMAN ENVIRONMENTAL	Filename: Atlas19-27-01-f10.mxd	**Figure**
	Scale: 1:125,000 (A4)	10
	Projection: GDA 1994 MGA Zone 51	
This map should only be used in conjunction with WEC report Atlas19-27-01.	Revision: 0- 29 August 2019	

Tables 10 and 11 present descriptions and the current extent of each VSA and Land System respectively mapped in the Compiled Study Area (Government of Western Australia 2019; van Vreeswyk *et al.* 2004). All three VSAs have been subject to very limited clearing, with less than 1% of each VSA having been permanently cleared since European settlement. However, none of the VSAs are protected for conservation (Table 10). Also note that three Land Systems were mapped at 1% or less of the Pilbara Study Area by van Vreeswyk *et al.* (2004) (Mosquito, Robe and Taylor Land Systems) (Table 11).

Table 10: Vegetation System Associations Intersecting the Study Area (Government of Western Australia 2019)

Vegetation System Association	Description	Extent in the Study Area (ha) (%)	Current Regional Extent (ha)	Percentage of Pre-European Extent Remaining	Percentage of Current Extent Protected for Conservation
Abydos Plain – Chichester_173	Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt.	4295.3 66.8% of Compiled Study Area	617,717.85	99.39	0
Abydos Plain – Chichester_190	Hummock grasslands, sparse shrub steppe; *Acacia bivenosa & A. trachycarpa* over hard spinifex, *Triodia wiseana*, Very poor rocky country on gneiss.	6.4ha 0.1% of Compiled Study Area	169,051.00	99.91	0
George Ranges_171	Hummock grasslands, low tree steppe; snappy gum over soft spinifex & *Triodia brizioides*.	2127.2ha 33.1% of Compiled Study Area	269,111.46	99.53	0

Table 11: Vegetation of the Land Systems mapped within the Compiled Study Area (van Vreeswyk *et al.* 2004)

Land System	Total Mapped Extent (ha)	Extent in the Compiled Study Area (ha)	Description of Vegetation associated with Land System
Capricorn	529,600 2.9% of Pilbara Study Area	2888.3 44.9% of Compiled Study Area	**Ridges, hills and upper slopes, and lower footslopes** Hummock grasslands of *Triodia wiseana*, *T. brizoides* (hard spinifex) or *T. pungens* (soft spinifex) with scattered *Acacia inaequilatera* (kanji) and other *Acacia* spp. and *Grevillea wickhamii* (Wickham's grevillea) **Stony plains** Hummock grasslands of *T. wiseana* or *T. pungens* with scattered *Acacia* spp. shrubs **Narrow drainage floors and channels** Scattered tall shrublands or low woodlands with *Acacia* spp., *Corymbia hamersleyana* (Hamersley bloodwood), numerous other shrubs and soft spinifex

Land System	Total Mapped Extent (ha)	Extent in the Compiled Study Area (ha)	Description of Vegetation associated with Land System
Mosquito	184,000 1% of the Pilbara Study Area	23.2ha 0.4% of Compiled Study Area	**Ridges and Hills** Hummock grasslands of *Triodia wiseana* (hard spinifex) with isolated shrubs such as *Acacia aphanoclada* **Lower footslopes** Hummock grasslands of *T. wiseana* with isolated shrubs **Stony Plains** Patchy hummock grasslands of *T. wiseana*, *Triodia longiceps* (hard spinifex) with isolated or very scattered shrubs such as *Acacia trachycarpa*, *A. synchronicia* **Stony Saline Plains** Patchy hummock grasslands of *T. longiceps* with isolated to scattered shrubs *Acacia, Senna* and *Maireana* spp. **Drainage Lines and Channels** Scattered to close tall shrublands/woodlands with *Acacia* spp., *Eucalyptus victrix* (coolibah), *Eucalyptus. camaldulensis* (river red gum) with hummock grass *Triodia* spp. or tussock grass including *Cenchrus ciliaris* (buffel grass) understorey. Also hummock grasslands of *Triodia* spp. (hard or soft spinifex).
Robe	86,500 0.5% of the Pilbara Study Area	255.5 4.0% of Compiled Study Area	**Low plateaux, mesas and buttes** Hummock grasslands of *Triodia pungens* (soft spinifex) with isolated to scattered *Acacia* and *Senna* spp. shrubs and occasional *Eucalyptus leucophloia* (snappy gum) trees **Lower slopes and Gravelly Plains** Hummock grasslands of *T. wiseana*, *T. longiceps* (hard spinifex) with isolated to very scattered *Acacia* and *Senna* spp. shrubs; occasionally hummock grasslands of *T. pungens* (soft spinifex) **Drainage Floors and Channels** Hummock grasslands of *T. pungens* with very scattered to moderately close *Acacia* spp. shrubs. Also moderately close eucalypt or acacia woodlands/tall shrublands with *T. pungens* understorey
Rocklea	2,299,300 12.7% of the Pilbara Study Area	2929.6 45.6% of Compiled Study Area	**Hills, ridges, plateaux and upper slopes; Lower slopes** Hummock grasslands of *T. wiseana*, *Triodia*. spp. (hard spinifex) or, less frequently, of *T. pungens* (soft spinifex) with isolated to very scattered shrubs such as *Acacia inaequilatera* (kanji) and *Senna* spp **Stony plains and interfluxes** Hummock grasslands of *T. wiseana* or, less frequently, *T. pungens* with isolated to very scattered shrubs such as *A. inaequilatera* (PHSG, PSSG). Occasionally grassy shrublands with *Acacia*, *Senna* and *Eremophila* spp. **Gilgai Plains** Tussock grasslands with *Astrebla pectinata* (barley Mitchell grass), *Eragrostis xerophila* (Roebourne Plains grass) and other perennial grasses **Upper drainage lines** Hummock grasslands of *T. wiseana* or *T. pungens* with very scattered to scattered acacia shrubs and occasional *Corymbia hamersleyana* (Hamersley bloodwood) trees **Drainage floors and channels** Scattered to moderately close tall shrublands or woodlands of *Acacia* and *Eucalyptus* spp. with numerous undershrubs and hummock grass understoreys or tussock grass understoreys

Land System	Total Mapped Extent (ha)	Extent in the Compiled Study Area (ha)	Description of Vegetation associated with Land System
Talga	212,400 1.2% of the Pilbara Study Area	30.8 0.5% of Compiled Study Area	**Hills and Ridges** Hummock grasslands of *T. wiseana*, *T. lanigera*, *Triodia*. spp., (hard spinifex) or, less frequently, *T. pungens* (soft spinifex) with isolated to scattered shrubs such as *A. inaequilatera* (kanji), *A. orthocarpa* and *Senna* spp. (cassias) **Lower footslopes** Hummock grasslands of *T. wiseana*, *T. plurinervata*, *Triodia* spp. or, less frequently, *T. pungens* with isolated to scattered shrubs particularly *A. inaequilatera* (kanji) and *Senna* spp **Stony Plains** Hummock grasslands of *T. wiseana*, *T. lanigera*, *T. plurinervata* or, less frequently, *T. pungens* with isolated to scattered shrubs of *Acacia* and *Senna* spp. **Drainage floors and channels** Hummock grasslands of *T. pungens* with isolated to very scattered shrubs. Scattered to moderately close tall shrublands/woodlands of *Acacia* spp., *E. victrix* (coolibah), *E. camaldulensis* (river red gum) with understorey of *T. pungens* or tussock grasses including *Chrysopogon fallax* (ribbon grass) and *C. ciliaris* (buffel grass).
Taylor	12,900 0.07% of the Pilbara Study Area	299.4 4.7% of Compiled Study Area	**Hills** Hummock grasslands of *T. wiseana*, *Triodia* spp. (hard spinifex) or, occasionally, *T. pungens* (soft spinifex) with isolated to very scattered *Acacia* spp. shrubs **Stony Plains** Hummock grasslands of *T. wiseana*, *T. longiceps* or *T. pungens* (hard and soft spinifex) with isolated to very scattered shrubs such as *A. inaequilatera* (kanji), *A. bivenosa* (two vein wattle) **Sandy surfaced plains** Hummock grasslands and shrubby hummock grasslands with *T. pungens* and isolated to scattered mid height and tall shrubs such as *A. ancistrocarpa* (shiny leaf wattle) and other *Acacia* spp. **Drainage floors** Hummock grasslands of *T. pungens* with isolated to very scattered shrubs or scattered to moderately close tall shrublands of *Acacia* spp. with understorey of *T. pungens*

5.1.4.1 Groundwater Dependent Vegetation

According to the Groundwater Dependent Ecosystem (GDE) Atlas the McPhee Creek Compiled Study Area is within an area classified as having a low to moderate potential groundwater dependent terrestrial ecosystems based on a national assessment (Bureau of Meteorology 2019c). The Nullagine River itself is classified as being of High potential GDE (aquatic GDE; national assessment), however the three creeklines which formed the riparian study area were not assessed.

5.1.4.2 Significant Vegetation

A list of significant vegetation known from within or in the vicinity of the Study Area is presented in Table 12. This list has been compiled from the results of current searches of DBCA's TEC and PEC Database, DoEE's SPRAT Database, and the results of local surveys as outlined in Section 5.1.1. One vegetation type formally listed as significant vegetation is

known from within the vicinity of the Compiled Study Area (Figure 11). Appendix A presents definitions, categories and criteria for TECs and PECs (DBCA 2013a).

Results of the DBCA TEC and PEC Database search (DBCA 2019c) indicate that no TECs are known from within the Compiled Study Area. Although two TECs are currently known from the Pilbara Bioregion, no TECS are currently listed as occurring within 40 km of the Compiled Study Area. Following a review of the current DBCA TEC and PEC lists (DBCA 2018, 2019a), no other listed significant vegetation types are likely to occur within or in the immediate vicinity of the Study Area. The search of the DoEE SPRAT database with regards to Matters of National Environmental Significance (MNES) listed under the EPBC Act did not return any TECs as likely or known to occur within the search area (DoEE 2019). The results of the DoEE search are presented in Appendix C.

Table 12: Significant Vegetation Known from the Vicinity of the Compiled Study Area

Community	Conservation Status (W.A.)	EPBC Act ranking	Source
Stony Saline Clay Plains of the Mosquito Land System	PEC (Priority 3)	-	DBCA

The Mosquito Land System was defined by van Vreeswyk *et al.* (2004), and was mapped on relatively few areas, the largest of which is located immediately to the south of the Compiled Study Area. Five separate landforms were described in this Land System (Table 11), of which one contains vegetation defined as being associated with the PEC. ''Stony saline plains''were estimated to cover 25% of the mapped extent of the Mosquito Land System, and consisted of undulating plains and interfluves between frequent small drainage lines usually <500m apart. It was located on shallow red-brown non-cracking clays and red shallow loams, the vegetation consisting of 'Patchy hummock grasslands of *Triodia longiceps* with isolated to scattered shrubs: *Acacia*, *Senna* and *Mairena* spp.'.

The local and regional significance of VTs mapped by Woodman Environmental during surveys conducted in proximity to the Compiled Study Area were also described. The local significance assessments were based on potential to provide habitat for significant flora and relative extent mapped in the particular study area; regional significance was assessed in relation to the probablily of being restricted in the wider region as a result of uncommon substrates or other such factors, as well as known regional distribution:

- Six VTs mapped in the McPhee Creek rail project study area were listed as having higher local significance (''4''), mainly due to the restricted extents mapped in that study area. Of these, none were considered to be of regional significance (Woodman Environmental 2014c)
- Six VTs mapped in the McPhee Creek Rail Spur study area (Woodman Environmental 2014d) were considered to be of local significance due to the limited areas of each mapped in that study area, and provision of habitat for significant flora taxa. Of these, three were also considered to be potentially regionally significant, due to the limited regional extent known.
- Eight VTs mapped in the extended Corunna Downs survey area (Woodman Environmental 2016) were considered to be of local significance due to their limited extent mapped in the local study area, and the provision of suitable habitat for significant flora. Of these, four were considered to be potentially regionally significant, mainly through the known or presumed restricted nature of their regional extents.

170000 195000 220000 245000

7650000 7625000 7600000 7575000 7550000

Legend

- McPhee Creek Compiled Study Area
- DBCA Search Area

Significant Vegetation

- Stony saline clay plains of the Mosquito Land System

170000 195000 220000 245000

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Significant Vegetation Returned from the DBCA Database Searches

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f11.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

11

5.2 Field Survey Results

5.2.1 Vascular Flora Census

A total of 388 discrete vascular flora taxa and nine hybrids were recorded in the Compiled Study Area by these three surveys, including 373 native taxa and 15 introduced taxa. These taxa represent 51 families and 165 genera. The most well-represented families were Fabaceae (75 taxa), Poaceae (62 taxa) and Malvaceae (36 taxa).

Average native taxon richness per quadrat was 32.5 (± 14.4), with the greatest number of taxa recorded in a single quadrat being 78, and the lowest number being 5. A full list of taxa is presented in Appendix E, with raw quadrat data and parameters presented in Appendix F. Appendix G presents nomenclature which has been updated since the original survey reports.

5.2.2 Significant Flora Taxa

A total of four significant flora taxa were recorded during the 2012 and 2013 surveys of the Compiled Study Area. No Threatened flora taxa were recorded within the Study Area. Locations of significant flora taxa are presented in Appendix H and on Figure 12, as well as on the detailing vegetation mapping as presented in Appendix O.

Table 13 presents a list of significant flora taxa recorded in the Compiled Study Area during the surveys, with the total number of locations and individuals recorded. Table 14 presents a breakdown of the number of locations and individuals recorded in each mapped VT.

Table 13: Summary of Significant Flora Taxa Recorded within the Study Area

Taxon	Conservation Status	Number of Locations Recorded in Compiled Study Area	Number of Individuals Recorded in Compiled Study Area
Acacia aphanoclada	P1	1	1
Eragrostis crateriformis	P3	70	1348
Ptilotus mollis	P4	297	6387
Rostellularia adscendens var. *latifolia*	P3	4	5

200000 205000 210000 215000

7615000 7610000 7605000 7600000 7595000 7590000

Legend

McPhee Creek Compiled Study Area

Significant Flora

- Aap *Acacia aphanoclada* (P1)
- Ecr *Eragrostis crateriformis* (P3)
- Pmo *Ptilotus mollis* (P4)
- Radl *Rostellularia adscendens* var. *latifolia* (P3)

200000 205000 210000 215000

WOODMAN ENVIRONMENTAL

N

This map should only be used in conjunction with WEC report Atlas19-27-01.

Overview of Significant Flora Taxa of the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f12.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

12

Table 14: Number of Locations and Individuals of Significant Flora Recorded in the Compiled Study Area

VT	*Acacia aphanoclada* (P1)		*Eragrostis crateriformis* (P3)		*Ptilotus mollis* (P4)		*Rostellularia adscendens* var. *latifolia* (P3)	
	Number of Locations	Number of Individuals	Number of Locations	Number of Individuals	Number of Locations	Number of Individuals	Number of Locations	Number of Individuals
1	1	1	4	21	242	5423	-	-
2	-	-	1	6	-	-	-	-
3a	-	-	-	-	-	-	-	-
3b	-	-	1	20	-	-	-	-
4	-	-	-	-	4	115	-	-
5	-	-	-	-	9	93	-	-
6a	-	-	-	-	8	47	-	-
6b	-	-	-	-	-	-	-	-
7	-	-	30	458	-	-	1	2
8a	-	-	2	285	-	-	-	-
8b	-	-	1	100	-	-	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	34	709	-	-
11	-	-	-	-	-	-	-	-
12a	-	-	-	-	-	-	-	-
12b	-	-	26	372	-	-	-	-
13	-	-	-	-	-	-	1	-
14	-	-	-	-	-	-	1	-
15	-	-	-	-	-	-	1	-
C	-	-	2	51	-	-	-	-
Total	**1**	**1**	**67**	**1313**	**297**	**6387**	**4**	**2**

5.2.2.1 Listed Significant Flora Taxa

Four listed significant flora taxa were recorded by these surveys within the Compiled Study Area. These are detailed below.

***Acacia aphanoclada* (P1)**

Acacia aphanoclada (P1) (Nullagine Ghost Wattle) is a very slender, upright, single-stemmed shrub growing to 5 m in height (Plate 1). Branches exhibit a weeping form with sparse foliage of long thin leaves and have distinctive spiny stipules in the leaf axes. Yellow flowers are present from August to October. This species is generally found on rocky slopes and ridges over stony soils (WA Herbarium 1998-). This taxon is endemic to Western Australia (Atlas of Living Australia (ALA) 2019).

The geographical distribution of this taxon is known from 34 WA records and is restricted to a range of approximately 65km in the vicinity of Nullagine, south of Marble Bar (WA Herbarium 1998-). There are approximately 20 populations, many of which are known from single records, comprising six localities within this range. Three of these populations

constitute the locations which were recorded by Woodman Environmental in the Compiled Study Area, as described below. Woodman Environmental has not previously recorded this taxon during any previous surveys conducted for Atlas Iron.

Acacia aphanoclada (P1) was recorded from one location within the McPhee Creek study area during the May 2012 vegetation survey, consisting of one individual plant (Figure 12). The location of the single plant recorded was considered atypical of the geology and landform on which the taxon normally occurs. A population of 20 or more plants was recorded outside the Study Area along the borefields track, 3.5 km south of the Study Area also during this survey (see Appendix H). These two occurrences represented new records for the taxon and a minor range extension of 9 km north of previously recorded locations. No new populations of *Acacia aphanoclada* (P1) were discovered within the McPhee creek study area during the targeted significant flora survey in April 2013, nor was any further suitable habitat for this taxon identified. This location is within the area of mapped VT 1 (Appendix O; Sheet O5).

Acacia aphanoclada (P1) was subsequently opportunistically collected approximately 30 metres outside of the Riparian study area near quadrat MCC-33 during the May 2013 survey. Five individuals were recorded on red-brown sandy loam on rocky lowerslopes (Appendix H; Appendix O; Sheet O21)).

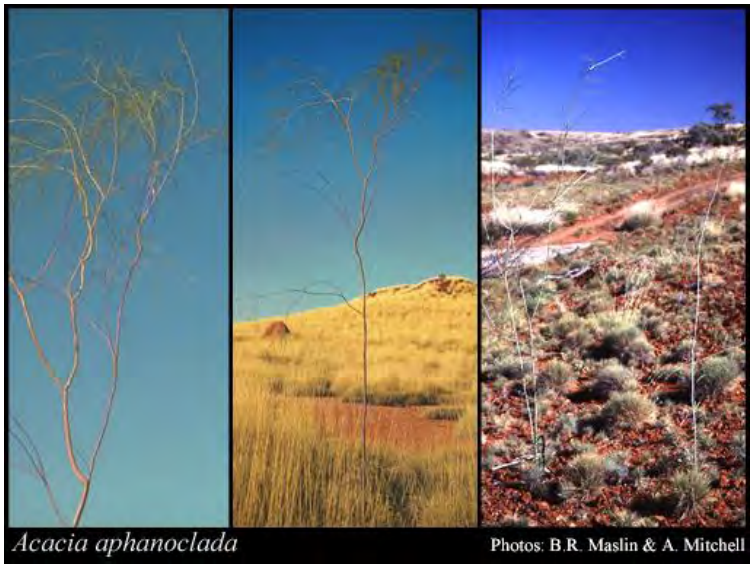


Plate 1: *Acacia aphanoclada* (P1) (Photo: WA Herbarium 1998-)

Eragrostis crateriformis (P3)

Eragrostis crateriformis (P3) is an annual grass to 0.4 m in height (Plate 2), preferring wet areas in creek banks and depressions on clayey loam or clay (Western Australian Herbarium (1998-). The distribution of this taxon within Western Australia is known from 45 records, occurring over a wide range (approximately 1400 km) from Yanrey Station near Onslow in the west, Port Hedland, Millstream National Park south of Karratha to Balgo Hills south of Halls Creek (Western Australian Herbarium 1998-). There are in excess of 25 regional populations of this taxon known to occur in Western Australia (DBCA 2007-). Woodman Environmental has previously recorded this taxon during surveys for Atlas Iron other

projects throughout the Pilbara, including Corunna Downs, Rook East, Turner River Hub and on proposed railway corridors (Woodman Environmental 2016; 2014c; 2011b; 2007).

A total of approximately 100 individuals were recorded from one location in the McPhee Creek study area (constituting one population) during the May 2012 vegetation survey (Appendix H; Figure 12). Subsequently, several new populations of *Eragrostis crateriformis* (P3) were located within the McPhee Creek study area during the targeted significant flora survey (April 2013), consisting of 69 point locations with an estimated 1248 individuals. Plants of *Eragrostis crateriformis* (P3) were found in either a vegetative or reproductive (flowers and/or fruit) state during the survey. Several specimens with reproductive material were collected for submission to the WA Herbarium for positive identification by a taxonomist. Photographs were also taken of plants within populations previously not known.

No new locations of *Eragrostis crateriformis* (P3) were recorded during the Riparian study area survey in May 2013. Since significant taxa were only recorded within quadrats or opportunistically during traverses on foot or while driving along tracks it is possible that further locations may be found within this the riparian study area with more extensive searching, if suitable habitat exists. All locations of this taxon known from the Compiled Study Area are also presented in Appendix O (Sheets O4, O6, O8, O10).

This taxon was recorded predominantly in seasonally inundated habitats of high clay content within the McPhee Creek study area, including open or closed wet depressions, claypans and areas adjacent to creeks or riverbeds on lower lying areas surrounding the main range. It was recorded in seven VTs (Table 14), however it was recorded predominantly in VTs 7 and 12b, which are associated with drainage features. It was also recorded in two locations within areas mapped as Cleared.

Plate 2: ***Eragrostis crateriformis*** **(P3) (Photo: Woodman Environmental)**

***Ptilotus mollis* (P4)**

Ptilotus mollis (P4) is a low, compact perennial shrub with soft grey foliage to 0.5 m high (Plate 3), which occurs on stony hill tops and scree slopes (WA Herbarium 1998-). This taxon is endemic to Western Australia (ALA 2019), occurring over a range of approximately 640 km from near Karlamilyi National Park in the east (270 km south-east of Marble Bar), to Cane River Conservation Park in the west (65 km south-west of Pannawonica). There are 36 records of this taxon in Western Australia (WA Herbarium 1998-), within approximately 20 localities, some of which are in conservation estate. One of these localities is comprised of the records from the surveys conducted at McPhee Creek by Woodman Environmental; this general location is not on the edge of the taxon's known range. Woodman Environmental have previously recorded this taxon within several locations in the Pilbara, including near Marble Bar, and at Corunna Downs and Turner River Hub (Woodman Environmental 201b; 2016).

This taxon was originally recorded at 12 locations consisting of approximately 247 plants within the McPhee Creek study area during the May 2012 survey (Appendix H; Figure 12). During the targeted flora survey of the McPhee Creek study area in April 2013, *Ptilotus mollis* (P4) was recorded at 285 point locations, consisting of approximately 6140 plants (Appendix H; Figure 12). This taxon was predominantly recorded on steep upper slopes and ironstone scree slopes on hills around Crescent Moon (equivalent to the range that comprises the Robe Land System in the Compiled Study Area) and to the south, east and southeast of the main range. Plants also occurred on mid and lower slopes of the ironstone range in significantly lower numbers. For regional perspective, four additional point locations of *Ptilotus mollis* (of approximately 570 plants) were recorded opportunistically to the north of the Project Area, off the Marble Bar-Nullagine Road. The records were taken within VTs 1, 4, 5, 6a and 10, with VTs 1 and 10 forming preferred habitat for this taxon (Table 14); however, it was not widespread throughout either of these VTs. Appendix O (Sheets O4, O6, O8, O10) also present the locations of these records.

Plate 3: *Ptilotus mollis* (P4) (Photo: Woodman Environmental)

No further locations of *Ptilotus mollis* (P4) were recorded in the Riparian study area during the May 2013 survey. As stated previously, significant taxa were only recorded within

quadrats or opportunistically during traverses on foot or while driving along tracks. However, it is unlikely that further locations would be found within this part of the Compiled Study Area with more extensive searching, due to lack of suitable habitat for this taxon in this area.

Rostellularia adscendens var. latifolia (P3)

Rostellularia adscendens var. *latifolia* (P3) is a small herb growing up to 0.3 m in height (Plate 4). It inhabits drainage lines and rocky slopes within ironstone rich areas of the Pilbara (WA Herbarium 1998-). The range of this taxon is known from 39 records, ranging over 490 km from 120 km west of Tom Price to 120 km east of Marble Bar. It is known from approximately 32 localities, including several within the Karajini National Park (WA Herbarium 1998-). The Compiled Study Area is not on the edge of the taxon's known range. This taxon has been recorded by Woodman Environmental at other areas in the Pilbara region, including in the vicinity of Newman, and in the railway extension project and at Corunna Downs for Atlas Iron (Woodman Environmental 2014d; 2016); in the railway extension project, this taxon was recorded on granite outcropping rather than in drainage lines.

This taxon was originally recorded in one opportunistic location in the McPhee Creek Study area during the targeted survey (April 203), with two individuals in this location recorded. This area was adjacent to a minor drainage line, in VT 7. This taxon was subsequently recorded within three quadrats assessed within the Riparian study area in May 2013 (Appendix H, Figure 12). These occurrences represented a new location for the taxon; *Rostellularia adscendens var. latifolia* (P3*)* had not previously been recorded within the Compiled Study Area. The three locations in the Riparian study area were recorded in all three VTs mapped in this area (VTs 13, 14 and 15; Table 14).

At the time of survey, the specimen collected was recognised as *Rostellularia* however the species and intraspecies level identification was required to be verified. The specimen was submitted to the WA Herbarium for identification and was confirmed by experienced taxonomist Mike Hislop as being the conservation significant variant *Rostellularia adscendens* var. *latifolia* (P3). Additional searching for this taxon was not undertaken during the May 2013 survey, due to the uncertainty of its identification in the field. It is likely that this taxon is more widely present within the Riparian study area and may be also more widely present in drainage lines, and possible on rocky slopes in the McPhee Creek study area.

Plate 4: *Rostellularia adscendens* var. *latifolia* (P3) (Photo: WA Herbarium 1998-)

5.2.2.2 Risk Assessment – Further Significant Flora Taxa

As detailed in Section 5.1.2, a total of 27 significant flora taxa have been identified as potentially occurring in the vicinity of the Compiled Study Area during the current desktop review. Of these, four were recorded within the Compiled Study Area by the three surveys (Table 13).

Table 15 presents a review of the likelihood of presence of these 27 significant flora taxa within the Compiled Study Area. Fourteen of these taxa were identified during the original desktop review and it was noted at the time that all of these taxa would have been identifiable at time of survey, either because the survey period coincided with the taxon's flowering period, or the taxon can be identified reliably when in fruit or when sterile. Upon review of the other taxa which were returned during the current desktop review, these taxa also are either easily identifiable due to habit characteristics, or otherwise would have been in flower/fruit during the surveys. The majority of these taxa also were familiar to the lead botanists conducting the survey.

Although targeted survey using the transect method was not undertaken over the ironstone ridge area (suitable habitat for those taxa targeted for survey did not include ironstone ridges), a significant number of quadrats were assessed in these areas, as well as opportunistic collections taken whilst transecting between quadrats. As such, it is considered unlikely that these would in the McPhee Creek Study Area. However, as a targeted flora survey of the Riparian study area was not conducted, there is the possibility of further significant flora taxa occurring in this study area. There are a remaining nine taxa which may not have received adequate survey effort.

Table 15: Likelihood of Occurrence of Significant Flora Taxa

Significant Taxon	Cons. Status	Likelihood of Occurrence	Comment
Acacia aphanoclada	P1	*Known to occur*	*Recorded in Compiled Study Area* Habitat within the Study Area was considered to be atypical of the normal habitat of the taxon (individual was dead at time of survey); Unlikely to be recorded further in the Study Area
Acacia cyperophylla var. *omearana*	P1	Unlikely	Study Area not within known range. Habitat not known from within the Study Area. Very unique habit and bark; unlikely to have been overlooked during targeted survey.
Acacia fecunda	P1	Unlikely	Similar habitat occurs in the study area, some of which was not subject to targeted survey; Study Area not within the known range of this taxon.
Acacia levata	P3	Unlikely	Habitat unlikely to occur in the study area (no sheet granite outcropping on plains available); Study Area not within the known range of this taxon.
Acacia sp. Marble Bar (J.G. & M.H. Simmons 3499)	P1	Unlikely	Potential habitat not well understood as only one record of this taxon known; This taxon has not been recorded or collected since that time and it is thought the collection may represent a hybrid; Study Area is not close to the known record (40km away).
Acacia sp. Nullagine (B.R. Maslin 4955)	P1	Unlikely	Potential habitat not well understood as only one record of this taxon known (low-lying area between rocky hills on rocky clay); however most VT 7 was targeted for survey; Study Area is not close to the known record (40km away).
Atriplex spinulosa	P1	Unlikely	Potential habitat likely to be restricted to saline influenced areas (potentially VT 8a); this VT was at least partially targeted during the targeted survey; Study Area not near the known range of this taxon.
Bulbostylis burbidgeae	P4	Unlikely	Although known from one record in proximity to the Study Area, the habitat for this taxon is relatively specific and not recorded in the Study Area; The VTs of the vicinity of the known record were targeted for survey, and the taxon was not recorded.
Cochlospermum macnamarae	P1	Unlikely	Although this taxon was not returned during the original desktop searches, it was familiar to the surveyors at the time through other surveys in the Pilbara; Although known in relative proximity to the Study Area (14km), the habitat for this taxon is not known to occur it the Study Area; The habit of this taxon is very distinctive, and it is easily recognised and is distinctive in the field.
Eragrostis crateriformis	P3	*Known to occur*	*Recorded in Compiled Study Area* Recorded in the McPhee Creek study area; not likely to be recorded further as suitable habitat was targeted for survey.

Significant Taxon	Cons. Status	Likelihood of Occurrence	Comment
Eucalyptus rowleyi	P3	Unlikely	Although this taxon was not returned during the original desktop searches, it has a distinct habit and would have been collected if encountered; Although its habitat was not targeted for survey in the riparian study area, the study area is not in the vicinity of the known range of this taxon.
Fimbristylis sp. Shay Gap (K.R. Newbey 10293)	P1	*Potential* Riparian study area only	This taxon is known to occur in relative proximity to the Riparian study area, which was not targeted for survey; The regional range is not well known due relatively few known locations; Recorded from near pools in creeklines; Potential to occur in the riparian study area only.
Gomphrena leptophylla	P3	Unlikely	Potentially suitable habitat was targeted for survey; Study area is not near the known range of this taxon.
Goodenia nuda	P4	Unlikely	Several records are known from immediately west of the Compiled Study Area (Woodman Environmental (2014c)); however, the three collections taken from within this area were incompletely identified, due to either lack of flowers, or that the specimen did not completely match with the characteristics of *G. nuda*; Targeted survey for this taxon was undertaken in suitable habitat, and no locations were recorded; although this taxon was not returned in the original desktop search, the surveyors were aware of this taxon's characteristics; The location is outside of the main range of the taxon.
Gymnanthera cunninghamii	P3	Unlikely	Although suitable habitat occurs in the Riparian study area, the study area is not in proximity to the known range of this taxon (>60km); Limited suitable habitat for this taxon in the study area.
Heliotropium murinum	P3	Unlikely	Study area is not in proximity to the known range of this taxon (>30km); Although not on the original desktop search list, this taxon was known to the surveyors through other surveys; Areas which could be potential habitat were targeted for survey, with limited areas that had been recently burnt.
Heliotropium muticum	P3	Unlikely	Study area is not in proximity to the known range of this taxon (>30km); Areas which could be potential habitat were targeted for survey, with limited areas noted that had been recently burnt.

Significant Taxon	Cons. Status	Likelihood of Occurrence	Comment
Indigofera ixocarpa	P2	Unlikely	The study area is not in proximity to the range of the taxon; Nearest records themselves are outliers to the main range, and were recorded from the 'bed of a small drainage line, spreading on washout gravels' which is not the typical habitat of this taxon; Unique habit and likely to have been recorded if encountered during preivous surveys; Unlikely to occur, however if it does occur it would be potentially restricted to the riparian study area given the habitat of the nearest records.
Lepidium catapycnon	P4	Unlikely	Taxon is easily identifiable and known to surveyors; Study area is outside of the main range of the taxon, with the nearest records being >25km away, and the main range being >120km away.
Nicotiana umbratica	P3	Unlikely	This taxon was known to the surveyors, with likely areas surveyed; Habitat is large boulder outcrops which did not occur in the Study Area; Study area is outside the main range of this taxon.
Ptilotus mollis	P4	*Known to occur*	*Recorded in Compiled Study Area* Unlikely to occur further than currently recorded due to survey effort
Ptilotus wilsonii	P1	Unlikely	Study area is outside of the main range of this taxon; Suitable habitat targeted for survey.
Rostellularia adscendens var. *latifolia*	P3	*Known to occur*	*Recorded in Compiled Study Area* Recorded in four locations in four different VTs associated with drainage lines; Most of VT 7 was targeted for survey in the McPhee Creek study area, however no targeted survey was undertaken in the Riparian study area; May occur further in the Riparian study area portion of the Compiled study area.
Rothia indica subsp. *australis*	P3	Unlikely	This taxon was known to surveyors through previous surveys; Suitable habitat present which has been surveyed, however individuals can be cryptic and difficult to locate; The study area is not located in proximity to the main part of the range of this taxon (>70km), however is within the known range due to disjunct known locations.
Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795)	P1	Unlikely	The range of this taxon is relatively restricted, and is known to occur in the Mosquito Land system only; The study area is not within the known range of this taxon (>25km).

Significant Taxon	Cons. Status	Likelihood of Occurrence	Comment
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	*Potential*	One record of this taxon is known in proximity to the Riparian study area, although it is itself an outlier from the known main range of the taxon, and the identification has not been determined by appropriate botanists from the WA Herbarium; The study area is located on the edge of the known range; Although unlikely to occur in the Riparian study area, it has the potential to occur in habitats near this area.
Triodia basitricha	P3	Unlikely	The surveyors were familiar with the entity prior to its formal description as *T. basitricha*; Although the ironstone ranges were not targeted for survey, the area was traversed with quadrats and this taxon was not otherwise opportunistically recorded; The study area is outside of the main range of this taxon.

5.2.2.3 Distribution Extensions and Distribution Gaps

Compiled Study Area represented a range extension, filled locality holes or represented taxa with few vouchered collections at the WAHerbarium for many taxa recorded during the May 2012 and 2013 surveys. This is because of the relative paucity of surveys conducted in the local and wider area prior to these surveys.

Table 16 presents taxa where the collections from the Compiled Study Area represented significant extensions to the known distribution, or otherwise filled gaps within the known distribution of such taxa (in 2013).

Table 16: Taxa Where McPhee Creek Collections Represent Significant Range Extensions to the Known Ranges of these Taxa, or Fill Distribution Gaps (WA Herbarium 1998-)

Taxon	Description of Compiled Study Area Record
Abutilon macrum	Fills gap in known distribution
Abutilon malvifolium	Fills gap in known distribution
Acacia monticola x *tumida* var. *pilbarensis*	Extension of known distribution to the south
Aeschynomene indica	Fills gap in known distribution
Amaranthus cuspidifolius	Fills gap in known distribution
Bothriochloa ewartiana	Fills gap in known distribution
Chloris pectinata	Fills gap in known distribution
Corchorus incanus subsp. *incanus*	Fills gap in known distribution
Dactyloctenium radulans	Fills gap in known distribution
Dichanthium sericeum subsp. *humilius*	Fills gap in known distribution
Enteropogon ramosus	Fills gap in known distribution
Eragrostis leptocarpa	Fills gap in known distribution
Eriochloa pseudoacrotricha	Fills gap in known distribution
**Euphorbia hirta*	Fills gap in known distribution
Evolvulus alsinoides var. *villosicalyx*	Fills gap in known distribution
Grevillea wickhamii subsp. *hispidula*	Fills gap in known distribution
Gompholobium oreophilum	Extension of known distribution to the north
Haloragis gossei var. *inflata*	Extension of known distribution to the east
Melaleuca bracteata	Fills gap in known distribution
Olearia stuartii	Extension of known distribution to the north

Taxon	Description of Compiled Study Area Record
Operculina aequisepala	Fills gap in known distribution
Paraneurachne muelleri	Fills gap in known distribution
Parietaria cardiostegia	Extension of known distribution to the north
Rostellularia adscendens var. *latifolia* (P3)	Fills gap in known distribution
Sida ?macropoda (complex)	Extension of known distribution to the south
**Sonchus oleraceus*	Fills gap in known distribution
Sporobolus australasicus	Fills gap in known distribution
Tephrosia stipuligera	Extension of known distribution to the east
Tribulus occidentalis	Fills gap in known distribution

5.2.3 Introduced Taxa

A total of 15 introduced flora taxa were recorded within the Compiled Study Area in 2012 and 2013. Table 17 presents a list of these introduced flora taxa together with number of records, and ecological impact and invasiveness ratings for each one under the DBCA *Weed Prioritisation Process* (DBCA 2013b) for the Pilbara Region (DBCA 2014). Locations of introduced flora taxa are presented in Appendix G.

No introduced taxa recorded in the Compiled Study Area are Declared Pests (DPIRD 2019). No introduced taxa listed as WoNS (AWC 2019) were recorded in the Compiled Study Area. Nine of these introduced taxa are ranked as having High ecological impact for the DBCA Pilbara Region; the remainder are either Low, Unknown (indicating that not enough information was known about the impacts or invasiveness and further research is required before a rating can be allocated) or have not been ranked (potentially due to them not being found on DBCA managed lands) (DBCA 2014).

Please note two species previously listed as introduced taxa (*Cucumis melo* subsp. *agrestis* and *Portulaca oleracea*) are no longer classified by the WA Herbarium as weeds and therefore do not appear in the list below (WA Herbarium 1998-).

Table 17: Summary of Introduced Taxa Recorded within the Compiled Study Area

Taxon	Common Name (WA Herbarium 1998-)	Number of Locations Recorded in Compiled Study Area	Ecological Impact (DBCA 2014)	Invasiveness (DBCA 2014)
**Aerva javanica*	Kapok Bush	112	High	Rapid
**Argemone ochroleuca*	Mexican Poppy	12	Unknown	Rapid
**Cenchrus ciliaris*	Buffel Grass	217	High	Rapid
**Cenchrus setiger*	Birdwood Grass	28	High	Rapid
**Chloris barbata*	Feathertop Rhodes Grass	1	High	Rapid
**Citrullus amarus*	Pie Mellon	1	Unknown	Moderate
**Cynodon dactylon*	Couch	4	High	Rapid
**Echinochloa colona*	Awnless Barnyard Grass	24	High	Rapid
**Euphorbia hirta*	Asthma Plant	1	Low	Slow
**Flaveria trinervia*	Speedy Weed	1	-	-
**Malvastrum americanum*	Spiked Malvastrum	30	High	Rapid
**Portulaca pilosa*		2	-	-

Taxon	Common Name (WA Herbarium 1998-)	Number of Locations Recorded in Compiled Study Area	Ecological Impact (DBCA 2014)	Invasiveness (DBCA 2014)
**Setaria verticillata*	Whorled Pigeon Grass	3	High	Rapid
**Sonchus oleraceus*	Common Sowthistle	8	Low	Rapid
**Vachellia farnesiana*	Mimosa Bush	7	High	Rapid

Aerva javanica

Aerva javanica (Kapok) is a widespread weed of the Pilbara region, and is also common throughout the Kimberley. It is often found on sandy soils, along drainage lines or in disturbed areas. It is a short-lived soft-wooded herb to 1.6 m in height (Plate 5) (Hussey *et al.* 2007; WA Herbarium 1998-).

This taxon was recorded at seven locations in the McPhee creek study area in May 2012, often in drainage lines and disturbed areas, but occasionally on undisturbed upper slopes of hills (Appendix H). Cover was noted to be relatively minor. Scattered occurrences of relatively low densities of *Aerva javanica* were also recorded along the borefield track on the eastern side of the Study Area, mainly outside the Study Area boundary.

This taxon was also recorded at 17 locations throughout the riparian study area in May 2013 (Appendix H). Cover observed was likewise minor (<1%). Scattered occurrences of relatively low densities of *Aerva javanica* are also known from the vicinity of the Compiled Study Area.

Plate 5: *Aerva javanica* (Photo: Woodman Environmental)

Argemone ochroleuca

Argemone ochroleuca (Mexican Poppy) (Plate 6) is an erect herb growing to 1 m in height. It is known to occur along watercourses and road verges, and has a scattered distribution throughout the Pilbara, Gascoyne, Midwest and South-west regions (WA Herbarium 1998-). It is considered toxic to humans, livestock and wildlife due to a latex-like sap exuded by the plant when damaged.

This taxon was recorded within 12 quadrats within the riparian study area in May 2013, with covers of 0.1% recorded at each location (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 6: *Argemone ochroleuca* (Photo: WA Herbarium 1998-)

Cenchrus ciliaris

Cenchrus ciliaris (Buffel Grass) (Plate 7) is a widespread introduced taxon throughout roadsides, creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert. It was originally introduced into pastoral regions as a pasture grass and alters the fire characteristics by generating a high level of flammable fuel (Hussey *et al.* 2007).

Cenchrus ciliaris was recorded at nine locations within the McPhee Creek study area in May 2012 and dominated the understorey at three locations with foliage covers ranging from 40 – 85% (Appendix H). Scattered occurrences of varying densities of *Cenchrus ciliaris* were also recorded along the borefield track on the eastern side of the Study Area, mainly in drainage lines. *Cenchrus ciliaris* was also recorded opportunistically at 169 locations during the targeted significant flora survey (April 2013). This taxon was recorded at a further 39 locations within the Riparian study area in May 2013; it dominated the understorey at 15 of these locations (covers of >50%) (Appendix H).

Scattered occurrences of varying densities of *Cenchrus ciliaris* occur in the vicinity of the Study Area, mainly in or adjacent to drainage lines.

Plate 7: *Cenchrus ciliaris* (Photo: Woodman Environmental)

Cenchrus setiger

Cenchrus setiger (Birdwood Grass) is an introduced perennial known throughout the northern half of Western Australia (Plate 8). This tufted grass-like herb forms tussocky clumps up to 0.5 m high and spreads through stolons (runners). This taxon is a native to Africa and India, originally established in Australia as a fodder plant, and has become a widespread and serious weed from Geraldton to the Kimberley, particularly invading watercourses (Hussey *et al*. 2007).

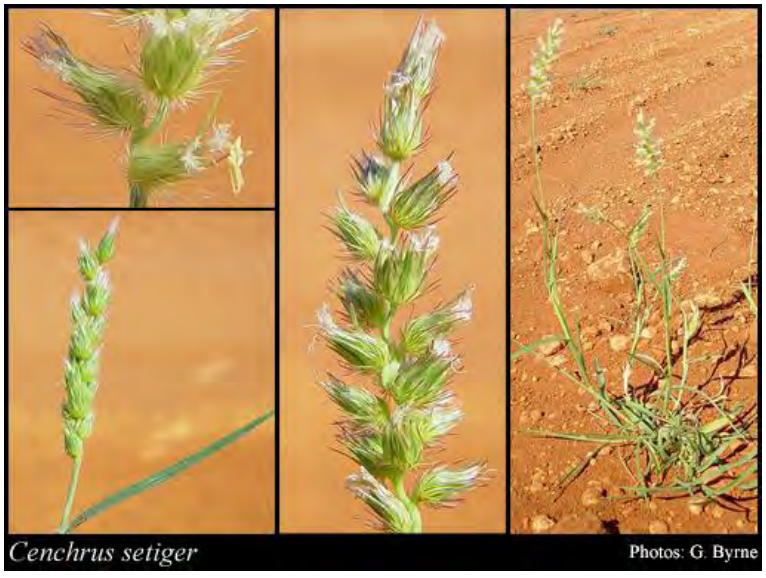


Plate 8: *Cenchrus setiger* (Photo: WA Herbarium 1998-)

Cenchrus setiger was recorded at two locations within the McPhee Creek study area during the May 2012 survey (Appendix H), with relatively low levels of cover recorded. It was also recorded opportunistically at a further 26 locations during the targeted significant flora survey (April 2013). It was not recorded in the Riparian study area.

Chloris barbata

Chloris barbata (Purpletop Chloris) (Plate 9) is a short-lived grass known from the Pilbara and Kimberley regions (WA Herbarium 1998-). It can grow up to 1 m in height, with purple flowers present in February or April to October.

Chloris barbata was recorded in one quadrat within the Riparian study area during the May 2013 survey, at a foliage cover of 0.1% (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 9: ***Chloris barbata*** **(WA Herbarium 1998-)**

Citrullus amarus

Citrullus amarus (Pie Melon) (Plate 10) is a trailing annual herb which grows on a variety of soil types and is commonly found on river banks, drainage areas and plains. This taxon is widely distributed in Western Australia, however there are few records of this species from the Pilbara bioregion (WA Herbarium 1998-). It was recorded at one location in the Riparian study area during the May 2013 survey, with a foliage cover of 0.3% recorded for the quadrat (Appendix H). *Citrullus amarus* was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 10: *Citrullus amarus* (Photo: Woodman Environmental)

Cynodon dactylon

Cynodon dactylon (Couch Grass) (Plate 11) is a perennial, rhizomatous grass growing to 0.3 m in height (WA Herbarium 1998-). Commonly used as a turf grass, this species is widely distributed throughout Western Australia (WA Herbarium 1998-). *Cynodon dactylon* was recorded at four locations in the Riparian study area during the May 2013 survey, with foliage cover ranging from 0.1% - 5% (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 11: *Cynodon dactylon* (WA Herbarium 1998-)

Echinochloa colona

Echinochloa colona (Awnless Barnyard Grass) (Plate 12) is a tufted, annual grass to 0.6 m high, which usually grows near watercourses or on floodplains. This species is widely distributed throughout the Kimberley, Pilbara, Carnarvon and Gascoyne bioregions (WA Herbarium 1998-). It was recorded in 24 quadrats within the Riparian study area during the May 2013 survey, with covers ranging from 0.1% to 5% (Appendix H). It was not recorded in the McPhee Creek project area during the May 2012 or April 2013 surveys.

Plate 12: *Echinochloa colona* (WA Herbarium 1998-)

Euphorbia hirta

Euphorbia hirta (Asthma Plant) (Plate 13) is predominantly found in the Kimberley region of Western Australia, although a small number of records are known from across the Pilbara. This multi-branched annual herb is found on floodplains and along watercourses, growing to 0.8 m high, and exudes a milky sap if the stem is damaged (WA Herbarium 1998-). It was recorded in one quadrat within the riparian study area in May 2013, at a cover of 0.2% (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 13: *Euphorbia hirta* (WA Herbarium 1998-)

Flaveria trinervia

Flaveria trinervia (Speedy Weed) is an erect herb or shrub to 1 m in height (Plate 14). Until recently this taxon was known as *Flaveria australasica* subsp. *australasica*, which was considered a native taxon. This taxon is widespread through the Pilbara region, and occurs in the Kimberley (WA Herbarium 1998-). It was recorded in one quadrat in the Riparian study area in May 2013, from a drainage line at low foliage cover of 0.1% (Appendix H). It was not recorded in the McPhee Creek project area during the May 2012 or April 2013 surveys.

Plate 14: *Flaveria trinervia* (Photo: Flora of Zimbabwe 2012)

Malvastrum americanum

Malvastrum americanum (Spiked Malvastrum) (Plate 15) is an introduced taxon which occurs in river and creek margins, wastelands and many arid zone habitats from the Kimberly to the Pilbara and Gascoyne regions (Hussey *et al.* 2007).

Plate 15: *Malvastrum americanum* (Photo: WA Herbarium 1998-)

It was recorded in seven quadrats established in drainage lines and a clay pan within the McPhee Creek study area during the May 2012 survey (Appendix H). The foliage cover of the taxon was relatively low, ranging from 0.1-0.5%. It was also recorded in seven opportunistic locations during the targeted flora survey in April 2013. This taxon was recorded in a further 16 quadrats established within the Riparian survey area during the May 2013 survey (Appendix H). The foliage cover of the taxon was relatively low at all locations, ranging from 0.1-0.3%.

Portulaca pilosa

Portulaca pilosa (Plate 16) is a succulent, erect or prostrate annual herb, growing to 0.2 m high. It is widespread through-out the Pilbara and Kimberley regions (WA Herbarium 1998-).

This taxon was recorded at one quadrat in the McPhee Creek study area during the May 2012 survey, at low levels of foliage cover (0.1%), and was not recorded during the targeted significant flora survey. It was also recorded at a second location in the Riparian study area, in one quadrat during the May 2013 survey, also at low levels of foliage cover (0.1%).

Plate 16: *Portulaca pilosa* (Photo: WA Herbarium 1998-)

Setaria verticillata

Setaria verticillata (Whorled Pigeon Grass) (Plate 17) is an introduced taxon found at locations across Western Australia, especially throughout the Pilbara region (WA Herbarium 1998-). It is a loosely tufted grass-like annual, flowering from December to June with a dense spike-like inflorescence and can reach heights of 1 m. *Setaria verticillata* is a widespread weed readily inhabiting disturbed soils and riverine edges (Hussey *et al*. 2007).

Setaria verticillata was found in low levels of foliage cover (0.1%) from three locations within the Riparian study area during the May 2013 survey (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 17: ***Setaria verticillata*** **(Photo: Environmental Weeds of Australia 2016)**

Sonchus oleraceus

Sonchus oleraceus (Common Sowthistle) (Plate 18) is an erect herb growing to 1.5 m high with yellow flowers. This species is known to thrive in areas of disturbance. It is found throughout Western Australia although records are concentrated in the south-west of the state, and there have only been scattered observations in the Pilbara region (WA Herbarium 1998-).

It was recorded in the Riparian study area during the May 2013 survey, in eight quadrats with very low foliage cover (Appendix H). These observations filled a locality hole in the previously known distribution of the taxon. It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 18: ***Sonchus oleraceus*** **(Photo: WA Herbarium 1998-)**

Vachellia farnesiana

Vachellia farnesiana (Mimosa Bush) (Plate 19) is a thorny, thicket-forming tree or shrub to 4 m high which grows on stony, sandy, clay or loam soils and is commonly found along river and creek banks and in low-lying areas. This taxon is widespread within the Pilbara bioregion (Herbarium, 1998-).

Vachellia farnesiana was recorded from six locations in the Riparian study area during the May 2013 survey, with very minor cover at each location (Appendix H). It was not recorded in the McPhee Creek study area during the May 2012 or April 2013 surveys.

Plate 19: ***Vachellia farnesiana*** **(Photo: WA Herbarium 1998-)**

5.2.4 Vegetation of the Study Area

5.2.4.1 Classification Results

Statistical analysis of taxon presence/absence data was performed on 125 quadrats from the original McPhee Creek Study Area (surveyed in May 2012) and 39 quadrats from the Riparian Study Area (surveyed in May 2013). Appendix I presents the taxa which were either removed from the analysis or amalgamated with other taxa. Removed taxa were a result of incomplete identifications (available material for specimen collection being of poor quality), or the taxa were of hybrid status. Amalgamations were undertaken where both complete and incomplete identifications of an entity were available, and the taxon with the incomplete identification occurred in similar vegetation. Taxa recorded from the Riparian Study Area were aligned with those previously aligned in the analysis for the McPhee Creek Study Area (Woodman Environmental 2014a).

Manual reassigning of eight quadrats (MC014, MC019, MC050, MC051, MC057, MC075, MC075, MC094 and MC097) considered to have been misclassified by the classification analysis was undertaken, following detailed investigation of individual quadrat datasets, and examination of field notes. During examination of the results of the floristic classification, it was discovered that a number of quadrats had grouped into particular VTs despite not possessing similar topographical and soil characters as the majority of quadrats they had grouped with. A number of potential reasons were identified as the cause of this; fire history, seasonal influence, inadvertent positioning of quadrats on the boundaries of different plant communities (within ecotones) and the presence of minor narrow drainage lines or small patches of clay within broad vegetation types, were considered to be the most common causes. These factors can drastically affect species richness and composition, and hence quadrat grouping. These quadrats were manually allocated to VTs that better reflected their topography, soil type and dominant vegetation composition. Appendix N presents a list of these quadrats and the reasoning behind the re-classification of each.

5.2.4.2 Vegetation Types

The 164 quadrats resultant floristic classification has resulted in two super-groups, which are further split into a total of 15 VTs, comprised of 19 sub-VTs. Figure 13.1 presents an overview of these VTs in the Compiled Study Area, and Figure 13.2 presents the descriptive legend. Table 18 presents a summary of the vegetation units in the Compiled Study Area, including a description of the vegetation unit, total area mapped, flora recorded and sampling of the VT.

Appendix J presents a list of vascular plant taxa recorded in each VT within the Compiled Study Area (quadrat data only). Appendix K presents the summary dendrogram of relationships between each quadrat used in the analysis. Appendix L presents the two-way table of the species and quadrats matrix produced. Appendix M presents significant indicator species for each VT. Appendix O presents the detailed mapping of the VTs over aerial photography, at a scale of 1:10 000 (Sheets O1 – O21).

The split between the two super-groups is based primarily on topographical location and the water-retention capacity of the landforms and associated soils, with distinct differences in species composition between the super-groups. Super-group 1 (VTs 1 – 12) (Woodman

Environmental 2014a) is composed of all quadrats from the original McPhee Creek Study Area which consists of vegetation on lower to upperslopes, hill crests/tops of large hills, low hills on undulating plains, outwash areas at the base of hills, narrow/minor drainage lines, steep rocky slopes of gorges and cliff faces on or surrounding the main range; and low rises adjacent to the main range. Super-group 1 is comprised of two sub-groups:

Subgroup 1a: VTs 1 – 6

Subgroup 1a was mapped over approximately two thirds of the McPhee Creek Study Area. This group generally consists of vegetation on lower to upperslopes and hill crests/tops of large hills, low hills on undulating plains, outwash areas at the base of hills, narrow/minor drainage lines, steep rocky slopes of gorges and cliff faces on or surrounding the main range; or on the steep upper slopes and hilltop/plateau of Crescent Moon (located in the Robe Land System in the Compiled Study Area). These VTs generally grouped together due to the presence of *Triodia epactia*, and occupied landforms and habitats that have a tendency to dry out more readily following seasonal rain.

The structure of the vegetation varied slightly depending on topographical location. In general, the VTs possessed similar structural layers particularly in the upperstorey, with differences seen in density and species composition of mid and lower layers depending on the habitat. The vegetation structure was generally composed of low isolated trees to Low Open Woodland (*Corymbia hamersleyana* and *Eucalyptus leucophloia*) over Low open Shrubland of mixed species over hummock grassland. VT 4 (on the Robe Land System) differed by the lack of a treed upperstorey.

In general, this subgroup is broadly representative of the Capricorn, Taylor and Robe Land Systems (van Vreeswyk *et al.* (2004)) and the George Ranges_179 VSA (Government of Western Australia (2019). The Robe Land System (van Vreeswyk *et al.* 2004) is equivalent to the area mapped as VTs 4 and 6a, however the broad vegetation description for this land system (Table 11) is not characteristic of either VT 4 or 6a. VT 1 (the most-widespread VT mapped) was also mapped in the Rocklea Land System/Abydos Plain-Chichester_173 VSA, which was more common to subgroup 1b. These differences can be attributed to the differences in scale of the surveys.

Subgroup 1b: VTs 7 – 12

Super-group 2 is comprised of VTs 7 through to 12b, occupying one third of the McPhee Creek Study Area. This group generally consisted of a range of vegetation from drainage lines (experiencing reasonable volumes of seasonal water flow) and associated floodplains, to flats and undulating plains; lower to upperslopes and hillcrests of low undulating hills; low hills, hillocks and low rises adjacent to the main range, and shallow basins and perched claypans occurring on the main range. VT 7 represents the vegetation of the drainage lines and associated floodplains present through the McPhee Creek Study Area.

VTs within subgroup 1b generally grouped together due to the presence of *Triodia wiseana*, and occupied landforms and habitats that have greater water-retention capacity (i.e. soils containing a higher clay content), remaining damp for lengthier periods than that of VTs of subgroup 1a following seasonal rain. The species richness of subgroup 1b was generally higher than that of subgroup 1a.

The structure of the vegetation varied considerably depending on topographical location and clay content of the soil. VTs occurred in drainage lines with reasonable water flows, in broad expanses of clay-based soils or small isolated pockets within more general vegetation types similar to those in subgroup 1a. The vegetation structure was generally comprised of low shrublands dominated by *Acacia* spp. over mixed grasslands, sometimes dominated by *Triodia* spp., on either claypans associated with the main range, or hill crests to low rises to undulating plains influenced by a mix of granite, ironstone, dolerite or calcrete on areas surrounding the main range.

In general, this subgroup is broadly representative of the Rocklea and partially the Taylor Land Systems, as mapped by van Vreeskwyk *et al.* (2004), and the Abydos Plain-Chichester_173 VSA as defined by Government of Western Australia (2019). The clay pan areas which form VT 8 are not documented in any of the land systems present in the Compiled Study Area (van Vreeswyk *et al.* 2004). This may be an artefact of the differences in scale of survey.

Supergroup 2: VTs 13 - 15

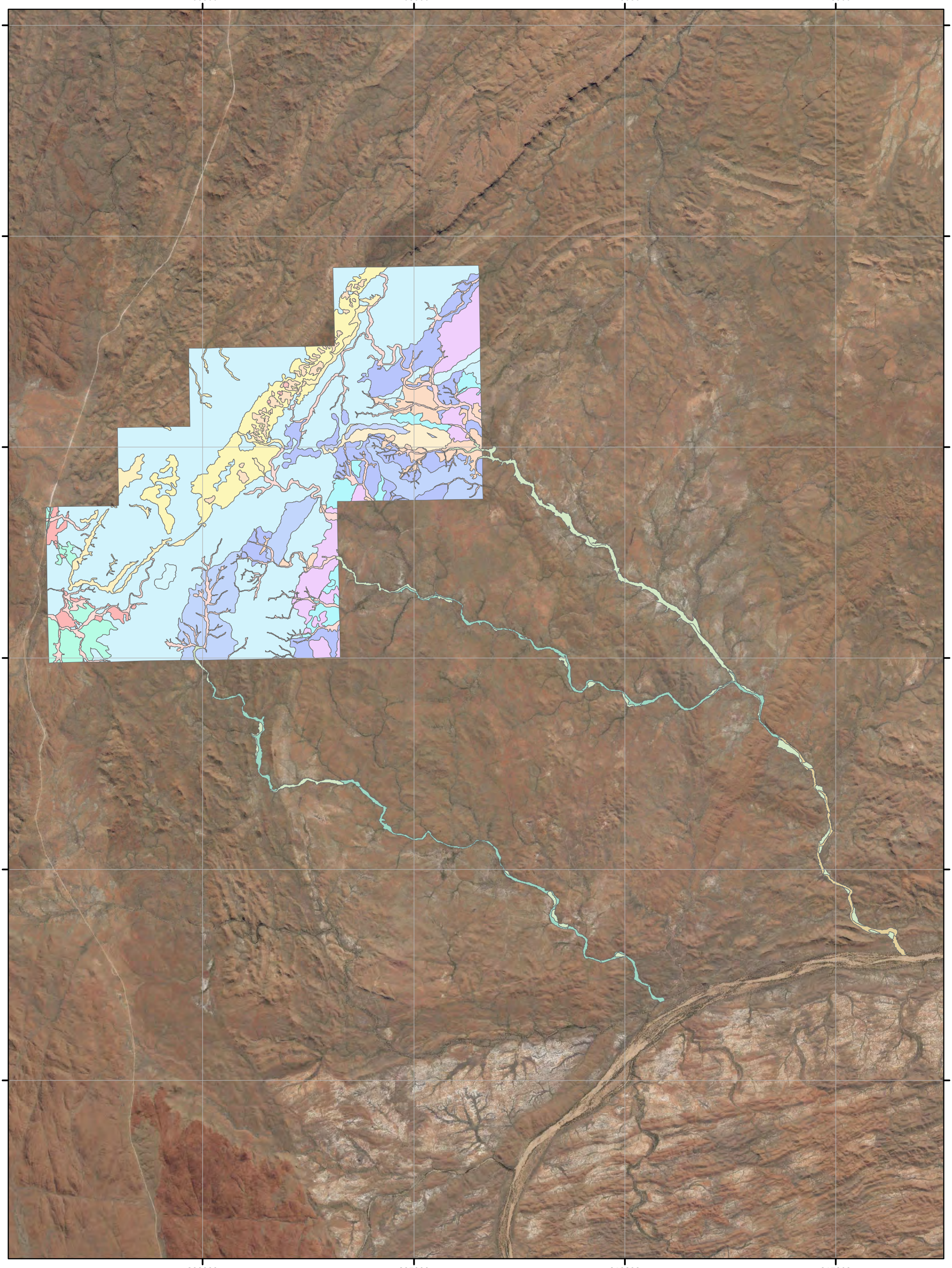
Super-group 2 is comprised from all quadrats established within the Riparian Study Area and consists of VTs 13 through to 15 (Woodman Environmental 2014b). This group consists of vegetation in major drainage lines that experience reasonable volumes of seasonal water flow and or retained water in ephemeral pools. These drainage lines extend from areas mapped as VT 7 (vegetation associated with the drainage lines from the main range and associated hills); however, significant differences are present between the species groups which define the split between these groupings (Appendix L).

The vegetation of these drainage lines was generally characterised by isolated trees to open forests of *Eucalyptus victrix* and *Eucalyptus camaldulensis*, over a mid and tall shrub layer dominated by *Acacia* species and *Atalaya hemiglauca* with mixed species typical of drainage lines, and a low shrub layer of mixed species. The understorey consisted of isolated hummocks to hummock grasslands dominated by *Triodia longiceps* and tussock grassland of *Cenchrus ciliaris* with a sparse sedgeland of *Cyperus vaginatus.*

This supergroup was also associated with areas mapped as the Rockea Land System, with the vegetation being characteristic of that described as occurring in drainage features of this land system (Table 11). Although the western creekline passes through an area mapped as the Talga Land System (Figure 7; Appendix O, Sheet O18), the vegetation of the creekline is not similar to that described of drainage features of that land system, with a significant tree overstorey present. The extreme southern extents of the creeklines surveyed all extend into the Mosquito Land System; the vegtation present is similar to that described as occurring in drainage features of this land system (Table 11).

200000 205000 210000 215000

7620000 7615000 7610000 7605000 7600000 7595000



200000 205000 210000 215000

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Overview of Vegetation Units of the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f13-1.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

13.1

Legend

Vegetation Types

1 Low Isolated Trees to Low Open Woodland of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* over Mid to Tall Isolated Clumps of Shrubs or Sparse to Open Shrubland of *Acacia inaequilatera*, *A. pyrifolia* var. *morrisonii* and/or *Grevillea wickhamii* subsp. *hispidula* (occasionally *A. bivenosa*, *A. eriopoda*, *A. monticola*, *A. orthocarpa*, *A. retivenea* subsp. *clandestina* or *A. synchronicia*) over Low Isolated Clumps of Shrubs to Low Shrubland of *Acacia ptychophylla* and/or *Indigofera monophylla* (occasionally *A. acradenia*, *Corchorus parviflorus*, *Dampiera candicans* or *Senna symonii*) over Low to Mid Hummock or Closed Hummock Grassland of *Triodia epactia* and/or *Triodia brizoides* on red, brown or red-brown sandy loam, sandy clay, clay loam or clayey sand, often with ironstone (predominantly), quartz or granite outcropping with granite, ironstone and/or quartz surface pebbles on hill crests, hill tops, mid to upperslope of hills, and lower slopes and outwash areas at the base of hills

2 Low Isolated to Low Isolated Clumps of Trees of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* over Mid Isolated Clumps of Shrubs to Mid Sparse Shrubland of *Acacia synchronicia* and/or *A. bivenosa* (very occasionally Tall Isolated Shrubs of *Acacia eriopoda* over Mid Isolated Clumps of Shrubs of *A. trachycarpa*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Acacia bivenosa* or *A. orthocarpa* and *Indigofera monophylla* over Low to Mid Hummock or Closed Hummock Grassland of *Triodia epactia* on brown sandy loam or red-brown clay loam or sandy clay loam, often with granite outcropping and some granite, ironstone and/or quartz surface pebbles on mid to lower slopes of low hills on undulating plains and outwash areas at the base of hills

3a Low Isolated Clumps of Trees of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* to Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Clumps of Shrubs to Tall Shrubland of *Acacia monticola* and/or *Grevillea wickhamii* subsp. *hispidula* (occasionally *Acacia tumida* var. *pilbarensis* in minor drainage lines) over Mid Isolated Clumps of Shrubs of *Gompholobium oreophilum* and *Senna glutinosa* subsp. *glutinosa* (or Mid Shrubland to Closed Shrubland of *Acacia tumida* var. *pilbarensis* or *Acacia monticola*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Acacia ptychophylla* and *Dampiera candicans* over Low Open Hummock to Mid Open Hummock Grassland of *Triodia epactia* and Low Isolated Clumps of Tussock Grasses to Low Open Tussock Grassland of *Eriachne lanata* or Low Sparse Tussock Grassland of *Eriachne mucronata* or Low Isolated Clumps of Tussock Grasses of *Amphipogon sericeus* on red-brown sandy loam, sandy clay loam or clay loam, with ironstone outcropping and ironstone surface pebbles in narrow/minor drainage lines and on crests, hill tops and hillslopes of low undulating hills on the main range

3b Low Isolated Trees of *Corymbia candida* subsp. ?*dipsodes* and *C. hamersleyana* or *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Shrubs to Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* and/or *Hakea chordophylla* over Low to Mid Hummock Grassland of *Triodia epactia* over Low Open to Low Tussock Grassland of *Amphipogon sericeus* (occasionally with Low Isolated Shrubs of *Acacia ptychophylla*) on red-brown sandy clay, clay loam or clayey sand, with ironstone surface pebbles and occasional ironstone outcropping on flat or simple slopes and tops of low hills or broad rises on the main range

4 Tall Isolated Clumps of Shrubs to Tall Closed Shrubland of *Acacia monticola* and *Grevillea wickhamii* subsp. *hispidula* over Low Tussock Grassland of *Eriachne lanata* and Low Open Hummock Grassland of *Triodia epactia* on brown to red-brown clay loam, with ironstone surface pebbles and occasional ironstone outcropping on hilltop/plateau of Crescent Moon

5 Low Isolated Trees to Low Isolated Clumps of Trees of *Corymbia candida* subsp. ?*dipsodes* and/or *Eucalyptus leucophloia* subsp. *leucophloia* (occasionally *Corymbia hamersleyana* or *Ficus brachypoda*) over Mid Isolated Shrubs to Tall Open Shrubland of *Acacia monticola* or *A. inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* over Low Hummock Grassland to Mid Closed Hummock Grassland of *Triodia epactia* (and occasionally *T. brizoides* or *T. wiseana*) and/or Low Isolated Clumps of Tussock Grasses to Low Open Tussock Grassland of *Cymbopogon ambiguus*, *Eriachne benthamii*, *E. ciliata* and *E. mucronata* on brown to red-brown clay loam, with granite or ironstone outcropping on steep to very steep rocky slopes of gorges and cliff faces on the main range

6a Low Isolated Trees to Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Open Shrubland of *Grevillea wickhamii* subsp. *hispidula* or Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* or *Senna glutinosa* subsp. *glutinosa* (and occasionally *S. glutinosa* subsp. *pruinosa*) over Low Hummock to Mid Closed Hummock Grassland of *Triodia epactia* and/or Low Sparse Tussock to Mid Isolated Clumps of Tussock Grasses of *Eriachne mucronata* (occasionally with *Eriachne lanata*) on brown clay loam or red-brown sandy loam, with ironstone outcropping on very steep upper slopes of Crescent Moon

6b Low Isolated Trees to Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Clumps of Shrubs to Tall Sparse Shrubland of *Acacia monticola* over Low to Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* (occasionally with *A. synchronicia*, *Corchorus parviflorus*, *Ptilotus obovatus*, *Senna glutinosa* subsp. *glutinosa*, *Senna Symonii* and/or *Tribulus suberosus*) over Low Hummock Grassland of *Triodia brizoides* (occasionally *T. wiseana*) and Low Isolated Clumps of Tussock Grasses to Mid Open Tussock Grassland of *Cymbopogon ambiguus* and *Eriachne mucronata* on brown to red-brown clay loam, with granite outcropping on very steep upper slopes on hills adjacent to the main range

7 Low Isolated Clumps of Trees to Mid Open Woodland of *Corymbia hamersleyana*, *Eucalyptus leucophloia* subsp. *leucophloia* and/or *E. victrix* (occasionally *C. candida* subsp. ?*dipsodes*) over Tall Sparse to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia* and *A. tumida* var. *pilbarensis* (occasionally *A. acradenia*, *A. inaequilatera*, *A. eriopoda, A. trachycarpa*, *Ehretia saligna* var. *saligna* and *Grevillea wickhamii* subsp. *hispidula*) over Mid Isolated Clumps of Shrubs to Mid Shrubland of *Acacia acradenia*, *A. bivenosa* and/or *A. trachycarpa* (occasionally **Aerva javanica*, *Gossypium australe*, *Carissa lanceolata*, *Petalostylis labicheoides*, *Santalum lanceolatum* or *Scaevola spinescens*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Corchorus parviflorus* and/or *Indigofera monophylla* over Low Isolated Hummock Grasses to Tall Closed Hummock Grassland of *Triodia epactia* and/or *T. longiceps* (occasionally with *T. wiseana*) over Low Isolated Tussock Grasses to Mid Closed Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Cymbopogon ambiguous* (occasionally **Cenchrus ciliaris*, *Digitaria brownii*, *Eriachne benthamii* and/or *E. mucronata*) and occasionally Low Isolated Clumps of Grasses of *Enneapogon lindleyanus* and *Paraneurachne muelleri* on brown to red-brown sandy loam, sandy clay, clay loam or sand in drainage lines (of any size) and associated floodplains adjacent to the main range

8a Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa*, *A. synchronicia* and/or *A. trachycarpa* (occasionally *Carissa lanceolata*) over Low Closed to Tall Open Hummock Grassland of *Triodia epactia*, *T. wiseana* and/or *T. longiceps* over Low Isolated Clumps of Tussock Grasses to Mid Open Tussock Grassland of **Cenchrus setiger, Chrysopogon fallax, Themeda triandra* and/or *Eragrostis setifolia* over Low Isolated Clumps of Grasses to Low Open Grassland of *Dichanthium sericeum* subsp. *humilius*, *Aristida contorta* and/or *Sporobolus australasicus* (occasionally with Low Isolated Trees of *Corymbia hamersleyana* over Mid to Tall Isolated Shrubs to Isolated Clumps of Shrubs of *Acacia inaequilatera* or Low Isolated Shrubs of *Corchorus lasiocarpus* subsp. *lasiocarpus* and *Sida echinocarpa* or Low Isolated Clumps of Shrubs of *Sida fibulifera*) on red to red-brown clayey sand, clay loam or sandy clay occasionally with ironstone, granite and quartz surface pebbles, in shallow basins or claypans on undulating plains adjacent to the main range

8b Mid Isolated Shrubs to Mid Isolated Clumps of Shrubs of *Acacia synchronicia* and *Senna symonii* (occasionally *S. artemisioides* subsp. *oligophylla*) over Mid to Tall Sparse Hummock Grassland of *Triodia longiceps, T. wiseana* and/or *T. epactia* over Low Isolated Clumps of Shrubs to Low Sparse Shrubland of *Streptoglossa bubakii* and *Sida ?macropoda* (complex) or *Sida* aff. *fibulifera* with Low Isolated to Low Isolated Clumps of Vines of *Operculina aequisepala* (occasionally with Low Isolated Clumps of Grasses of *Eriachne pulchella* subsp. *dominii*) on pale red-brown sandy clay or brown clay loam with ironstone, granite and quartz surface pebbles, in perched claypans on the main range

9 Mid to Tall Isolated Shrubs to Tall Open Shrubland of *Acacia bivenosa, A. orthocarpa, A. inaequilatera* and/or *Grevillea pyramidalis* subsp. *leucadendron* over Low Isolated Clumps of Shrubs of *Gomphrena cunninghamii*, *Corchorus lasiocarpus* subsp. *lasiocarpus, Gossypium australe, Indigofera rugosa* and/or *Senna artemisioides* subsp. *oligophylla* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* and/or *T. brizoides* on red to brown clay loam with granite, ironstone, dolerite and/or calcrete surface pebbles and dolerite, granite or ironstone outcropping, on low undulating hills, hillocks, hillcrests and low rises adjacent to the main range

10 Tall Isolated Shrubs to Tall Sparse Shrubland of *Acacia inaequilatera* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* (occasionally with Mid Isolated Shrubs to Isolated Clumps of Shrubs of *Senna glutinosa* subsp. *glutinosa* or *Acacia synchronicia* over Low Isolated Shrubs to Low Open Shrubland of *Acacia ptychophylla, Indigofera monophylla* or *Senna artemisioides* subsp. *helmsii*) on brown clay loam or red-brown sandy loam with granite, ironstone, quartz and/or calcrete surface pebbles and granite or ironstone outcropping, on undulating plains, lower slopes, mid slopes, low hills and hillocks adjacent to the main range

11 Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* (occasionally with Low Woodland of *Corymbia hamersleyana* or Mid Isolated Clumps of Shrubs of *Acacia orthocarpa* or Low Isolated Clumps of Shrubs of *Indigofera monophylla*) on red-brown to brown clay loam or sandy loam with ironstone, granite or quartz surface pebbles and ironstone or granite outcropping, on upperslopes, crests of hills, low undulating plains, low hills and hillocks adjacent to the main range

12a Low Isolated Clumps of Trees of *Corymbia hamersleyana* over Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Hummock to Low Closed Hummock Grassland of *Triodia angusta* and *T. wiseana* (occasionally with Mid Isolated Clumps of Shrubs of *Pluchea ferdinandi-muelleri*) on grey to brown clay loam with granite, ironstone, and/or calcrete surface pebbles, on flats and plains adjacent to the main range

12b Low Isolated to Low Isolated Clumps of Trees of *Corymbia hamersleyana* over Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* and *Corchorus parviflorus* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* on grey clay loam or brown sandy loam to sandy clay loam with calcrete (predominantly), ironstone and granite surface pebbles and calcrete outcropping, on low rises and hillocks on undulating plains

13 Low Isolated Clumps of Trees to Mid Open Woodland of *Eucalyptus victrix* (occasionally with *Corymbia hamersleyana* and *Eucalyptus camaldulensis*) over Tall Sparse Shrubland to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia, A. trachycarpa* and *Atalaya hemiglauca* over Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* over Low Isolated Clumps of Shrubs of **Aerva javanica*, *Gossipium australe* and *Sida rohlenae* subsp. *rohlenae* over Low Isolated Clumps of Hummock Grasses to Low Open Hummock Grassland of *Triodia longiceps* (occasionally with *T. wiseana*) over Low Isolated Clumps of Tussock Grasses to Low Tussock Grassland of **Cenchrus ciliaris* on red-brown or red sand or sandy loam in drainage lines and stony outwash areas associated with drainage lines

14 Mid Open Woodland to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Tall Sparse Shrubland to Tall Open Shrubland of *Acacia ampliceps*, *A. coriacea* subsp. *pendens*, *A. pyrifolia* subsp. *pyrifolia, A. trachycarpa*, *Atalaya hemiglauca*, *Melaleuca glomerata* and *Petalostylis labicheoides* over Low Isolated Clumps of Shrubs of *Cullen leucanthum* and *Sesbania cannabina* over Low Isolated Clumps of Hummock Grasses to Low Hummock Grassland of *Triodia longiceps* over Low Isolated Clumps of Tussock Grasses to Low Closed Tussock Grassland of **Cenchrus ciliaris* over Low Isolated Clumps of Sedges to Low Sparse Sedgeland of *Cyperus vaginatus* on red or red-brown sand, sandy loam or sandy clay in drainage lines associated with ephemeral pools

15 Mid Isolated Clumps of Trees to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Mid to Tall Isolated Clumps of Shrubs to Mid to Tall Open Shrubland of *Acacia pyrifolia* subsp. *pyrifolia, A. trachycarpa* and, *Atalaya hemiglauca* over Low Isolated Clumps of Shrubs of *Pluchea tetranthera*, *Sesbania cannibina* and *Stemodia grossa* over Low Isolated Clumps of Hummock Grasses of *Triodia longiceps* over Low Isolated Clumps of Tussock Grasses to Low Closed Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* over Low Isolated Clumps of Sedges to Low Open Sedgeland of *Cyperus vaginatus* on brown sand, sandy loam and sandy clay in drainage lines associated with granite outcropping

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Overview of Vegetation Units of the McPhee Creek Compiled Study Area

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f13-2.mxd

Revision: 0- 29 August 2019

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

13.2

Table 18: Summary of Vegetation Types Mapped in the Compiled Study Area

VT	Summary	Photograph
1	**Description:** Low Isolated Trees to Low Open Woodland of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* over Mid to Tall Isolated Clumps of Shrubs or Sparse to Open Shrubland of *Acacia inaequilatera*, *A. pyrifolia* var. *morrisonii* and/or *Grevillea wickhamii* subsp. *hispidula* (occasionally *A. bivenosa*, *A. eriopoda*, *A. monticola*, *A.orthocarpa*, *A. retivenea* subsp. *clandestina* or *A. synchronicia*) over Low Isolated Clumps Of Shrubs to Low Shrubland of *Acacia ptychophylla* and/or *Indigofera monophyla* (occasionally *A. acradenia*, *Corchorus parviflorus*, *Dampiera candicans* or *Senna symonii*) over Low to Mid Hummock or Closed Hummock Grassland of *Triodia epactia* and/or *Triodia brizoides* on red, brown or red-brown sandy loam, sandy clay, clay loam or clayey sand, often with ironstone (predominantly), quartz or granite outcropping with granite, ironstone and/or quartz surface pebbles on hill crests, hill tops, mid to upperslope of hills, and lower slopes and outwash areas at the base of hills. **Area mapped (Proportion of Study Area):** 3148.4 ha (48.97 %) **Sampling:** 43 quadrats (MC002, MC006, MC008, MC009, MC010, MC011, MC014, MC016, MC018, MC022, MC023, MC024, MC025, MC029, MC030, MC036, MC037, MC041, MC044, MC045, MC070, MC082, MC085, MC086, MC087, MC088, MC092, MC096, MC099, MC100, MC105, MC106, MC114, MC116, MC120, MC124, MC127, MC128, MC133, MC134, MC136, MC149). **Significant Taxa:** *Acacia aphanoclada* (P1), *Eragrostis crateriformis* (P3), *Ptilotus mollis* (P4) **Introduced Taxa:** None recorded **Indicator Taxa:** *Dodonaea coriacea* **Average Taxon Richness per Quadrat:** 27.3 ± 7.2 VT 1 was mapped widely in large areas over half of the Compiled Study Area (Appendix O: Sheets O1 – O6, O8 – O10), except in the mid-southeast corner (Sheet O6 (part) and O7). VT 1 was the predominant vegetation type of the Study Area, usually mapped on hills with granite or ironstone outcropping (sometimes a quartz-like rock) and outwash areas at the base of hills. A total of 152 vascular plant taxa were recorded in quadrats grouped in VT 1 (Appendix J).	 **Plate 20: VT 1 (Quadrat MC036) (Photo: Woodman Environmental)**

VT	Summary	Photograph
2	**Description:** Low Isolated to Low Isolated Clumps of Trees of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* over Mid Isolated Clumps of Shrubs to Mid Sparse Shrubland of *Acacia synchronicia* and/or *A. bivenosa* (very occasionally Tall Isolated Shrubs of *Acacia eriopoda* over Mid Isolated Clumps of Shrubs of *A. trachycarpa*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Acacia bivenosa* or *A. orthocarpa* and *Indigofera monophylla* over Low to Mid Hummock or Closed Hummock Grassland of *Triodia epactia* on brown sandy loam or red-brown clay loam or sandy clay loam, often with granite outcropping and some granite, ironstone and/or quartz surface pebbles on mid to lower slopes of low hills on undulating plains and outwash areas at the base of hills. **Area mapped (Proportion of Study Area):** 138.5 ha (2.15 %) **Sampling:** 5 quadrats (MC084, MC095, MC101, MC102, MC103) **Significant Taxa:** *Eragrostis crateriformis* (P3) **Introduced Taxa:** None recorded **Indicator Taxa:** *Fimbristylis dichotoma, Scaevola browniana* **Average Taxon Richness per Quadrat:** 28.2 ± 5.7 VT 2 was mapped in a small area mainly in the southwest corner of the Study Area, with a small section on the lower western boundary. This VT was usually associated with low hills of undulating plains and outwash areas with granite outcropping (Appendix O; Sheets O4, O8). A total of 66 vascular plant taxa were recorded in quadrats grouped in VT 2 (Appendix J).	 **Plate 21: VT 2 (Quadrat MC095) (Photo: Woodman Environmental)**

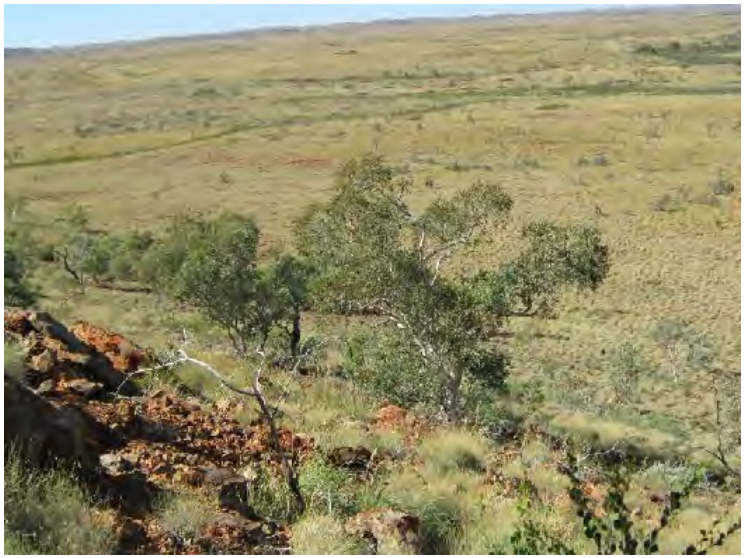
VT	Summary	Photograph
3a	**Description:** Low Isolated Clumps of Trees of *Corymbia hamersleyana* and/or *Eucalyptus leucophloia* subsp. *leucophloia* to Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Clumps of Shrubs to Tall Shrubland of *Acacia monticola* and/or *Grevillea wickhamii* subsp. *hispidula* (occasionally *Acacia tumida* var. *pilbarensis* in minor drainage lines) over Mid Isolated Clumps of Shrubs of *Gompholobium oreophilum* and *Senna glutinosa* subsp. *glutinosa* (or Mid Shrubland to Closed Shrubland of *Acacia tumida* var. *pilbarensis* or *Acacia monticola*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Acacia ptychophylla* and *Dampiera candicans* over Low Open Hummock to Mid Open Hummock Grassland of *Triodia epactia* and Low Isolated Clumps of Tussock Grasses to Low Open Tussock Grassland of *Eriachne lanata* or Low Sparse Tussock Grassland of *Eriachne mucronata* or Low Isolated Clumps of Tussock Grasses of *Amphipogon sericeus* on red-brown sandy loam, sandy clay loam or clay loam, with ironstone outcropping and ironstone surface pebbles in narrow/minor drainage lines and on crests, hill tops and hillslopes of low undulating hills on the main range. **Area mapped (Proportion of Study Area):** 413.9 ha (6.44 %) **Sampling:** 8 quadrats (MC003, MC004, MC013, MC017, MC032, MC038, MC040, MC119) **Significant Taxa:** None recorded **Introduced Taxa:** None recorded **Indicator Taxa:** *Bonamia media, Dampiera candicans, Gompholobium oreophilum* *Grevillea wickhamii* subsp. *hispidula, Ptilotus calostachyus, Sida* sp. Articulation below (A.A.Mitchell PRP 1605), *Triodia epactia* **Average Taxon Richness per Quadrat:** 28.6 ± 10.3 Within the Study Area VT 3a was mapped over a reasonably large area on the ironstone formation on top of the main range in the centre of the Study Area (Appendix O; Sheets O2 – O6). It was mainly mapped on stony low undulating hills and on the minor, narrow flow lines in this area. A total of 79 vascular plant taxa were recorded in quadrats grouped in VT 3a (Appendix J).	 **Plate 22: VT 3a (Quadrat MC003) (Photo: Woodman Environmental)**

VT	Summary	Photograph
3b	**Description:** Low Isolated Trees of *Corymbia candida* subsp. ?*dipsodes* and *C. hamersleyana* or *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Shrubs to Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* and/or *Hakea chordophylla* over Low to Mid Hummock Grassland of *Triodia epactia* over Low Open to Low Tussock Grassland of *Amphipogon sericeus* (occasionally with Low Isolated Shrubs of *Acacia ptychophylla*) on red-brown sandy clay, clay loam or clayey sand, with ironstone surface pebbles and occasional ironstone outcropping on flat or simple slopes and tops of low hills or broad rises on the main range. **Area mapped (Proportion of Study Area):** 74.1 ha (1.15 %) **Sampling:** 5 quadrats (MC019, MC031, MC034, MC039, MC043) **Significant Taxa:** *Eragrostis crateriformis* (P3) **Introduced Taxa:** None recorded **Indicator Taxa:** *Acacia ptychophylla, Amphipogon sericeus, Fimbristylis simulans, Goodenia stobbsiana, Hakea chordophylla* **Average Taxon Richness per Quadrat:** 18.0 ± 3.9 Within the Study Area VT 3b was mapped in small areas on the ironstone formation on top of the main range in the centre of the Study Area (Appendix O; Sheets O2, O5, O6). It was mainly mapped on broad stony flat areas or low rise and gave the appearance of grassy plains. A total of 36 vascular plant taxa were recorded in quadrats grouped in VT 3b (Appendix J).	 **Plate23: VT 3b (Quadrat MC039) (Photo: Woodman Environmental)**

VT	Summary	Photograph
4	**Description:** Tall Isolated Clumps of Shrubs to Tall Closed Shrubland of *Acacia monticola* and *Grevillea wickhamii* subsp. *hispidula* over Low Tussock Grassland of *Eriachne lanata* and Low Open Hummock Grassland of *Triodia epactia* on brown to red-brown clay loam, with ironstone surface pebbles and occasional ironstone outcropping on hilltop/plateau of Crescent Moon. **Area mapped (Proportion of Study Area):** 24.1 ha (0.37 %) **Sampling:** 2 quadrats (MC046, MC069) **Significant Taxa:** *Ptilotus mollis* (P4) **Introduced Taxa:** None recorded **Indicator Taxa:** *Eriachne lanata* **Average Taxon Richness per Quadrat:** 8.0 ± 0.0 VT 4 was mapped in a small area in the upper eastern section of the Study Area. It was mapped only on the plateau surface of Crescent Moon (Robe Land System in the Compiled Study Area) on stony flat areas that were either level or slightly sloping (Appendix O; Sheets O6, O7). A total of 11 vascular plant taxa were recorded in quadrats grouped in VT 4 (Appendix J).	 **Plate 24: VT 4 (Quadrat MC046) (Photo: Woodman Environmental)**

VT	Summary	Photograph
5	**Description:** Low Isolated Trees to Low Isolated Clumps of Trees of *Corymbia candida* subsp. ?*dipsodes* and/or *Eucalyptus leucophloia* subsp. *leucophloia* (occasionally *Corymbia hamersleyana* or *Ficus brachypoda*) over Mid Isolated Shrubs to Tall Open Shrubland of *Acacia monticola* or *A. inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* over Low Hummock Grassland to Mid Closed Hummock Grassland of *Triodia epactia* (and occasionally *T. brizoides* or *T. wiseana*) and/or Low Isolated Clumps of Tussock Grasses to Low Open Tussock Grassland of *Cymbopogon ambiguus*, *Eriachne benthamii*, *E. ciliata* and *E. mucronata* on brown to red-brown clay loam, with granite or ironstone outcropping on steep to very steep rocky slopes of gorges and cliff faces on the main range. **Area mapped (Proportion of Study Area):** 147.1 ha (2.29 %) **Sampling:** 6 quadrats (MC021, MC035, MC083, MC089, MC090, MC104) **Significant Taxa:** *Ptilotus mollis* (P4) **Introduced Taxa:** *Setaria verticillata* **Indicator Taxa:** *Acacia pruinocarpa*, *Amaranthus undulatus*, *Cyperus cunninghamii* subsp. *cunninghamii*, *Triumfetta maconochieana* **Average Taxon Richness per Quadrat:** 29.0 ± 15.2 VT 5 was mapped in small areas in the north-western half of the Study Area (Appendix O; Sheets O1, O2 – O6, O8, O9). It was mapped on steep rocky slopes and cliff faces of the main range. A total of 84 vascular plant taxa were recorded in quadrats grouped in VT 5 (Appendix J).	 **Plate 25: VT 5 (Quadrat MC090) (Photo: Woodman Environmental)**

VT	Summary	Photograph
6a	**Description:** Low Isolated Trees to Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Open Shrubland of *Grevillea wickhamii* subsp. *hispidula* or Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* or *Senna glutinosa* subsp. *glutinosa* (and occasionally *S. glutinosa* subsp. *pruinosa*) over Low Hummock to Mid Closed Hummock Grassland of *Triodia epactia* and/or Low Sparse Tussock to Mid Isolated Clumps of Tussock Grasses of *Eriachne mucronata* (occasionally with *Eriachne lanata*) on brown clay loam or red-brown sandy loam, with ironstone outcropping on very steep upper slopes of Crescent Moon. **Area mapped (Proportion of Study Area):** 88.8 ha (1.38 %) **Sampling:** 4 quadrats (MC047, MC063, MC064, MC068) **Significant Taxa:** *Ptilotus mollis* (P4) **Introduced Taxa:** *Aerva javanica* **Indicator Taxa:** *Eucalyptus leucophloia* subsp. *leucophloia*, *Hibiscus goldsworthii*, *Pluchea ferdinandi-muelleri*, *Pluchea tetranthera*, *Ptilotus incanus*, *Senna glutinosa* subsp. *glutinosa*, *Sida* ?*macropoda* (complex), *Sida rohlenae* subsp. *rohlenae*, *Sida* sp. Pilbara (A.A. Mitchell PRP 1543) **Average Taxon Richness per Quadrat:** 34.5 ± 6.4 VT 6a was mapped in a small area in the upper eastern section of the Study Area (Appendix O; Sheets O6, O7). It was mapped only on the rocky slopes of Crescent Moon (range of the Robe Land System). A total of 62 vascular plant taxa were recorded in quadrats grouped in VT 6a (Appendix J).	 **Plate 26: VT 6a (Quadrat MC068) (Photo: Woodman Environmental)**

VT	Summary	Photograph
6b	**Description:** Low Isolated Trees to Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Tall Isolated Clumps of Shrubs to Tall Sparse Shrubland of *Acacia monticola* over Low to Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* (occasionally with *A. synchronicia*, *Corchorus parviflorus*, *Ptilotus obovatus*, *Senna glutinosa* subsp. *glutinosa*, *Senna symonii* and/or *Tribulus suberosus*) over Low Hummock Grassland of *Triodia brizoides* (occasionally *T. wiseana*) and Low Isolated Clumps of Tussock Grasses to Mid Open Tussock Grassland of *Cymbopogon ambiguus* and *Eriachne mucronata* on brown to red-brown clay loam, with granite outcropping on very steep upper slopes on hills adjacent to the main range. **Area mapped (Proportion of Study Area):** 59.0 ha (0.92 %) **Sampling:** 4 quadrats (MC077, Mc113, MC142, MC143) **Significant Taxa:** None recorded **Introduced Taxa:** *Aerva javanica* **Indicator Taxa:** *Goodenia triodiophila*, *Hibiscus coatesii*, *Indigofera trita*, *Ptilotus obovatus*, *Senna glutinosa* subsp. *pruinosa*, *Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90), *Tephrosia supina*, *Triodia brizoides*, *Tribulus suberosus* **Average Taxon Richness per Quadrat:** 35.8 ± 9.5 VT 6b was mapped in a number of small areas, mainly in the northeast of the Study Area with an outlying occurrence in the south (Appendix O; Sheets O3, O7, O9). It was mapped on rocky granite hills with steep slopes, on hills adjacent to the main range. A total of 68 vascular plant taxa were recorded in quadrats grouped in VT 6b (Appendix J).	 **Plate 27: VT 6b (Quadrat MC077) (Photo: Woodman Environmental)**

VT	Summary	Photograph
7	**Description:** Low Isolated Clumps of Trees to Mid Open Woodland of *Corymbia hamersleyana*, *Eucalyptus leucophloia* subsp. l*eucophloia* and/or *E. victrix* (occasionally *C. candida* subsp. ?*dipsodes*) over Tall Sparse to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia* and *A. tumida* var. *pilbarensis* (occasionally *A. acradenia, A. inaequilatera, A. eriopoda, A. trachycarpa, Ehretia saligna* var. *saligna* and *Grevillea wickhamii* subsp. *hispidula*) over Mid Isolated Clumps of Shrubs to Mid Shrubland of *Acacia acradenia, A. bivenosa* and/or *A. trachycarpa* (occasionally **Aerva javanica, Gossypium australe, Carissa lanceolata, Petalostylis labicheoides, Santalum lanceolatum* or *Scaevola spinescens*) over Low Isolated Clumps of Shrubs to Low Open Shrubland of *Corchorus parviflorus* and/or *Indigofera monophylla* over Low Isolated Hummock Grasses to Tall Closed Hummock Grassland of *Triodia epactia* and/or *T. longiceps* (occasionally with *T. wiseana*) over Low Isolated Tussock Grasses to Mid Closed Tussock Grassland of *Themeda triandra, Chrysopogon fallax* and *Cymbopogon ambiguous* (occasionally **Cenchrus ciliaris, Digitaria brownii, Eriachne benthamii* and/or *E. mucronata*) and occasionally Low Isolated Clumps of Grasses of *Enneapogon lindleyanus* and *Paraneurachne muelleri* on brown to red-brown sandy loam, sandy clay, clay loam or sand in drainage lines (of any size) and associated floodplains adjacent to the main range. **Area mapped (Proportion of Study Area):** 330.4 ha (5.14 %) **Sampling:** 13 quadrats (MC007, MC042, MC074, MC091, MC093, MC098, MC107, MC111, MC125, MC135, MC144, MC145, MC151) **Significant Taxa:** *Eragrostis crateriformis* (P3) (preferred habitat); *Rostellularia adscendens* var. *latifolia* (P3) **Introduced Taxa:** *Aerva javanica, Cenchrus ciliaris, Cenchrus setiger, Flaveria trinervia, Malvastrum americanum* and *Setaria verticillata* **Indicator Taxa:** *Acacia acradenia*, *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis*, *Alternanthera nana*, *Corchorus parviflorus*, *Eucalyptus victrix*, *Evolvulus alsinoides* var. *decumbens*, *Gossypium robinsonii*, *Jasminum didymum* subsp. *lineare*, *Melhania oblongifolia*, *Tephrosia rosea* var. *clementii* **Average Taxon Richness per Quadrat:** 58.9 ± 10.7 Within the Compiled Study Area VT 7 was mapped widely over small areas, except for the northwest section which comprises the bulk of the main range (Appendix O; Sheets O2 – O10). These drainage lines occurred on the periphery of the main range, between the surrounding hills and undulating plains. It was always mapped in drainage lines experiencing seasonal flows of reasonable volumes and was characterised by a suite of species that prefer this habitat, including *Eucalyptus victrix*. A total of 182 vascular plant taxa were recorded in quadrats grouped in VT 7 (Appendix J).	 **Plate 28: VT 7 (Quadrat MC098) (Photo: Woodman Environmental)**

VT	Summary	Photograph
8a	**Description:** Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa*, *A. synchronicia* and/or *A. trachycarpa* (occasionally *Carissa lanceolata*) over Low Closed to Tall Open Hummock Grassland of *Triodia epactia*, *T. wiseana* and/or *T. longiceps* over Low Isolated Clumps of Tussock Grasses to Mid Open Tussock Grassland of **Cenchrus setiger, Chrysopogon fallax, Themeda triandra* and/or *Eragrostis setifolia* over Low Isolated Clumps of Grasses to Low Open Grassland of *Dichanthium sericeum* subsp. *humilius*, *Aristida contorta* and/or *Sporobolus australasicus* (occasionally with Low Isolated Trees of *Corymbia hamersleyana* over Mid to Tall Isolated Shrubs to Isolated Clumps of Shrubs of *Acacia inaequilatera* or Low Isolated Shrubs of *Corchorus lasiocarpus* subsp. *lasiocarpus* and *Sida echinocarpa* or Low Isolated Clumps of Shrubs of *Sida fibulifera*) on red to red-brown clayey sand, clay loam or sandy clay occasionally with ironstone, granite and quartz surface pebbles, in shallow basins or claypans on undulating plains adjacent to the main range. **Area mapped (Proportion of Study Area):** 133.0 ha (2.07 %) **Sampling:** 7 quadrats (MC012, MC051, MC078, MC146, MC150, MC152, MC153) **Significant Taxa:** *Eragrostis crateriformis* (P3) **Introduced Taxa:** *Cenchrus ciliaris, Cenchrus setiger, Malvastrum americanum* **Indicator Taxa:** *Abutilon lepidum*, *Indigofera colutea*, *Ptilotus aervoides*, *Sclerolaena costata*, *Streptoglossa liatroides*, *Trianthema ufoensis* **Average Taxon Richness per Quadrat:** 44.6 ± 15.0 VT 8a was mapped in small areas in the south-eastern section of the Study Area (Appendix O; Sheets O3, O4, O6, O7, O10). It was mapped on undulating plains in shallow basins or claypans that remain moist for an extended period, adjacent to the main range. A total of 126 vascular plant taxa were recorded in quadrats grouped in VT 8a (Appendix J).	 **Plate 29: VT 8a (Quadrat MC146) (Photo: Woodman Environmental)**

VT	Summary	Photograph
8b	**Description:** Mid Isolated Shrubs to Mid Isolated Clumps of Shrubs of *Acacia synchronicia* and *Senna symonii* (occasionally *S. artemisioides* subsp. *oligophylla*) over Mid to Tall Sparse Hummock Grassland of *Triodia longiceps, T. wiseana* and/or *T. epactia* over Low Isolated Clumps of Shrubs to Low Sparse Shrubland of *Streptoglossa bubakii* and *Sida ?macropoda* (complex) or *Sida* aff. *fibulifera* with Low Isolated to Low Isolated Clumps of Vines of *Operculina aequisepala* (occasionally with Low Isolated Clumps of Grasses of *Eriachne pulchella* subsp. *dominii*) on pale red-brown sandy clay or brown clay loam with ironstone, granite and quartz surface pebbles, in perched claypans on the main range. **Area mapped (Proportion of Study Area):** 2.6 ha (0.04 %) **Sampling: 2** quadrats (MC147, MC148) **Significant Taxa:** *Eragrostis crateriformis* (P3) **Introduced Taxa:** *Cenchrus setiger* **Indicator Taxa:** *Abutilon malvifolium*, *Austrobryonia pilbarensis*, *Bergia pedicellaris*, *Brachyachne convergens*, *Carissa lanceolata*, *Corchorus tridens*, *Cullen graveolens*, *Cyperus iria*, *Desmodium muelleri*, *Dysphania rhadinostachya* subsp. *rhadinostachya*, *Eragrostis crateriformis*, *Eragrostis tenellula*, *Eriachne pulchella* subsp. *dominii*, *Euphorbia boophthona*, *Haloragis gossei* var. *inflata*, *Neptunia dimorphantha*, *Operculina aequisepala*, *Phyllanthus maderaspatensis*, *Polygala isingii*, *Ptilotus nobilis*, *Senna notabilis*, *Streptoglossa bubakii* **Average Taxon Richness per Quadrat:** 49.5 ± 12.0 VT 8b was mapped in very small areas in the centre of the Compiled Study Area (Appendix O; Figures O2, O6). It was mapped in perched claypans nestled within undulating plains of the ironstone formation on top of the main range. A total of 72 vascular plant taxa were recorded in quadrats grouped in VT 8b (Appendix J).	 **Plate 30: VT 8b (Quadrat MC148) (Photo: Woodman Environmental)**

VT	Summary	Photograph
9	**Description:** Mid to Tall Isolated Shrubs to Tall Open Shrubland of *Acacia bivenosa, A. orthocarpa, A. inaequilatera* and/or *Grevillea pyramidalis* subsp. *leucadendron* over Low Isolated Clumps of Shrubs of *Gomphrena cunninghamii, Corchorus lasiocarpus* subsp. *lasiocarpus, Gossypium australe, Indigofera rugosa* and/or *Senna artemisioides* subsp. *oligophylla* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* and/or *T. brizoides* on red to brown clay loam with granite, ironstone, dolerite and/or calcrete surface pebbles and dolerite, granite or ironstone outcropping, on low undulating hills, hillocks, hillcrests and low rises adjacent to the main range **Area mapped (Proportion of Study Area):** 331.9 ha (5.16 %) **Sampling:** 6 quadrats (MC066, MC129, MC130, MC131, MC138, MC140) **Significant Taxa:** None recorded **Introduced Taxa:** *Cenchrus ciliaris* **Indicator Taxa:** *Boerhavia coccinea*, *Cucumis maderaspatanus*, *Goodenia muelleriana*, *Grevillea pyramidalis* subsp. *leucadendron*, *Triumfetta clementii* **Average Taxon Richness per Quadrat:** 42.3 ± 7.6 This vegetation type (rocky hills with tall scattered Acacia and *Triodia wise*ana/*brizoides*) is similar to VT 10 and 11 but has species rich pockets (areas of high moisture retention) amongst the general vegetation. VT 9 was mapped in reasonably large areas on the eastern side of the Study Area (Appendix O; Sheets O3, O6, O7, O10). It was usually mapped on low undulating stony hills and rises adjacent to the main range. A total of 110 vascular plant taxa were recorded in quadrats grouped in VT 9 (Appendix J).	 **Plate 31: VT 9 (Quadrat MC130) (Photo: Woodman Environmental)**

VT	Summary	Photograph
10	**Description:** Tall Isolated Shrubs to Tall Sparse Shrubland of *Acacia inaequilatera* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* (occasionally with Mid Isolated Shrubs to Isolated Clumps of Shrubs of *Senna glutinosa* subsp. *glutinosa* or *Acacia synchronicia* over Low Isolated Shrubs to Low Open Shrubland of *Acacia ptychophylla, Indigofera monophylla* or *Senna artemisioides* subsp. *helmsii*) on brown clay loam or red-brown sandy loam with granite, ironstone, quartz and/or calcrete surface pebbles and granite or ironstone outcropping, on undulating plains, lower slopes, mid slopes, low hills and hillocks adjacent to the main range. **Area mapped (Proportion of Study Area):** 495.7 ha (7.71%) **Sampling:** 9 quadrats (MC048, MC050, MC053, MC057, MC072, MC075, MC080, MC121, MC137) **Significant Taxa:** *Ptilotus mollis* (P4) **Introduced Taxa:** *Portulaca pilosa* **Indicator Taxa:** *Acacia inaequilatera* **Average Taxon Richness per Quadrat:** 17.6 ± 12.5 This vegetation type (low rocky/stony hills with tall scattered Acacia and *Triodia wiseana*) is similar to VT 9 however was more species poor; and similar to VT 11 but lacking the presence of *Acacia orthocarpa*. Within the Compiled Study Area VT 10 was mapped predominantly in large areas, in the south-eastern half of the Study Area (Appendix O; Sheets O2 – O7; O9 and O10). It was usually mapped on undulating stony plains and low hills southeast of the main range. A total of 83 vascular plant taxa were recorded in quadrats grouped in VT 10 (Appendix J).	 **Plate 32: VT 10 (Quadrat MC050) (Photo: Woodman Environmental)**

VT	Summary	Photograph
11	**Description:** Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* (occasionally with Low Woodland of *Corymbia hamersleyana* or Mid Isolated Clumps of Shrubs of *Acacia orthocarpa* or Low Isolated Clumps of Shrubs of *Indigofera monophylla*) on red-brown to brown clay loam or sandy loam with ironstone, granite or quartz surface pebbles and ironstone or granite outcropping, on upperslopes, crests of hills, low undulating plains, low hills and hillocks adjacent to the main range. **Area mapped (Proportion of Study Area):** 447.9 ha (6.97 %) **Sampling:** 5 quadrats (MC059, MC108, MC109, MC110, MC122) **Significant Taxa:** None recorded **Introduced Taxa:** None recorded **Indicator Taxa:** *Indigofera monophylla*, *Senna artemisioides* subsp. *oligophylla* **Average Taxon Richness per Quadrat:** 17.6 ± 3.5 This vegetation type (rocky hills with tall scattered Acacia and *Triodia wiseana*) is similar to VT 10, however usually contained *Acacia orthocarpa*; and is similar to VT 9, however was species poor. Within the Compiled Study Area VT 11 was mapped predominantly in large areas, in the south-eastern half of the Study Area (Appendix O; Sheets O6, O7, O9 and O10). It was usually mapped on undulating stony plains and low to large hills southeast of the main range. A total of 46 vascular plant taxa were recorded in quadrats grouped in VT 11 (Appendix J).	 **Plate 33: VT 11 (Quadrat MC059) (Photo: Woodman Environmental)**

VT	Summary	Photograph
12a	**Description:** Low Isolated Clumps of Trees of *Corymbia hamersleyana* over Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Hummock to Low Closed Hummock Grassland of *Triodia angusta* and *T. wiseana* (occasionally with Mid Isolated Clumps of Shrubs of *Pluchea ferdinandi-muelleri*) on grey to brown clay loam with granite, ironstone, and/or calcrete surface pebbles, on flats and plains adjacent to the main range. **Area mapped (Proportion of Study Area):** 161.1 ha (2.51 %) **Sampling:** 3 quadrats (MC060, MC067, MC073) **Significant Taxa:** None recorded **Introduced Taxa:** *Cenchrus ciliaris* **Indicator Taxa:** *Hakea lorea* subsp. *lorea*, *Stackhousia intermedia, Stackhousia* ?*intermedia*, *Swainsona stenodonta*, *Triodia angusta* **Average Taxon Richness per Quadrat:** 12.0 ± 2.6 VT 12a was mapped in relatively large scattered areas, but predominantly in the upper eastern section of the Compiled Study Area (Appendix O; Sheets O3, O6, O7, O10). It was mapped on plains and flats, usually adjacent to drainage lines, southeast of the main range. A total of 23 plant taxa were recorded in quadrats grouped into VT 12a (Appendix J).	 **Plate 34: VT 12a (Quadrat MC060) (Photo: Woodman Environmental)**

VT	Summary	Photograph
12b	**Description:** Low Isolated to Low Isolated Clumps of Trees of *Corymbia hamersleyana* over Tall Isolated Clumps of Shrubs of *Acacia inaequilatera* over Low Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* and *Corchorus parviflorus* over Low Hummock to Mid Closed Hummock Grassland of *Triodia wiseana* on grey clay loam or brown sandy loam to sandy clay loam with calcrete (predominantly), ironstone and granite surface pebbles and calcrete outcropping, on low rises and hillocks on undulating plains. **Area mapped (Proportion of Study Area):** 54.2 ha (0.84 %) **Sampling:** 3 quadrats (MC081, MC094, MC097) **Significant Taxa:** *Eragrostis crateriformis* (P3) **Introduced Taxa:** None recorded **Indicator Taxa:** *Goodenia microptera*, *Heliotropium pachyphyllum* **Average Taxon Richness per Quadrat:** 29.3 ± 12.2 VT 12b was mapped in small scattered areas in the lower western section of the Compiled Study Area (Appendix O; Sheets O4, O8). It was mapped on stony low rises and hillocks (predominantly calcrete) of the undulating plains southwest of the main range. A total of 65 plant taxa were recorded in quadrats grouped into VT 12b (Appendix J).	 **Plate 35: VT 12b (Quadrat MC081) (Photo: Woodman Environmental)**

VT	Summary	Photograph
13	**Description:** Low Isolated Clumps of Trees to Mid Open Woodland of *Eucalyptus victrix* (occasionally with *Corymbia hamersleyana* and *Eucalyptus camaldulensis*) over Tall Sparse Shrubland to Tall Shrubland of *Acacia pyrifolia* subsp. *pyrifolia, A. trachycarpa* and *Atalaya hemiglauca* over Mid Isolated Clumps of Shrubs to Mid Open Shrubland of *Acacia bivenosa* over Low Isolated Clumps of Shrubs of **Aerva javanica*, *Gossipium australe* and *Sida rohlenae* subsp. *rohlenae* over Low Isolated Clumps of Hummock Grasses to Low Open Hummock Grassland of *Triodia longiceps* (occasionally with *T. wiseana*) over Low Isolated Clumps of Tussock Grasses to Low Tussock Grassland of **Cenchrus ciliaris* on red-brown or red sand or sandy loam in drainage lines and stony outwash areas associated with drainage lines. **Area mapped (Proportion of Study Area):** 187.2 ha (2.91 %) **Sampling:** 12 quadrats (MCC-01, MCC-02, MCC-03, MCC-04, MCC-05, MCC-07, MCC-16, MCC-19, MCC-35, MCC-36, MCC-37, MCC-39) **Significant Taxa:** *Rostellularia adscendens* var. *latifolia* (P3) **Introduced Taxa:** *Aerva javanica, Cenchrus ciliaris, Echinochloa colona, Portulaca pilosa, Sonchus oleraceus* **Indicator Taxa:** *Corchorus incanus* subsp. *incanus, Enneapogon robustissimus, Eremophila longifolia, Melaleuca bracteata, Phyllanthus maderaspatensis, Polymeria ambigua* **Average Taxon Richness per Quadrat:** 32.0 ± 8.6	 **Plate 36: VT 13 (Quadrat MCC-19) (Photo: Woodman Environmental)**

VT	Summary	Photograph
14	**Description:** Mid Open Woodland to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Tall Sparse Shrubland to Tall Open Shrubland of *Acacia ampliceps*, *A. coriacea* subsp. *pendens*, *A. pyrifolia* subsp. *pyrifolia, A. trachycarpa, Atalaya hemiglauca*, *Melaleuca glomerata* and *Petalostylis labicheoides* over Low Isolated Clumps of Shrubs of *Cullen leucanthum* and *Sesbania cannabina* over Low Isolated Clumps of Hummock Grasses to Low Hummock Grassland of *Triodia longiceps* over Low Isolated Clumps of Tussock Grasses to Low Closed Tussock Grassland of **Cenchrus ciliaris* over Low Isolated Clumps of Sedges to Low Sparse Sedgeland of *Cyperus vaginatus* on red or red-brown sand, sandy loam or sandy clay in drainage lines associated with ephemeral pools. **Area mapped (Proportion of Study Area):** 41.8 ha (0.65 %) **Sampling:** 8 quadrats (MCC-15, MCC-17, MCC-18, MCC-20, MCC-21, MCC-22, MCC-23, MCC-24) **Significant Taxa:** None recorded **Introduced Taxa:** *Aerva javanica, Argemone ochroleuca, Cenchrus ciliaris, Citrullus amarus, Cynodon dactylon, Echinochloa colona, Euphorbia hirta, Sonchus oleraceus* **Indicator Taxa:** *Acacia ampliceps, Acacia coriacea* subsp. *pendens, Alternanthera angustifolia, Amaranthus cuspidifolius, Amaranthus ?cuspidifolius, Ammannia baccifera, Atalaya hemiglauca, Boerhavia ?repleta, Cullen leucanthum, Cyperus iria, Cyperus ?iria, Eucalyptus camaldulensis, Melaleuca glomerata, Petalostylis labicheoides, Pluchea rubelliflora, Sesbania cannabina, Triodia longiceps, Vigna lanceolata* var. *lanceolata* **Average Taxon Richness per Quadrat:** 29.5 ± 5.2	 **Plate 37: VT 14 (Quadrat MCC-20) (Photo: Woodman Environmental)**

VT	Summary	Photograph
15	**Description:** Mid Isolated Clumps of Trees to Mid Open Forest of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Mid to Tall Isolated Clumps of Shrubs to Mid to Tall Open Shrubland of *Acacia pyrifolia* subsp. *pyrifolia, A. trachycarpa* and*, Atalaya hemiglauca* over Low Isolated Clumps of Shrubs of *Pluchea tetranthera, Sesbania cannibina* and *Stemodia grossa* over Low Isolated Clumps of Hummock Grasses of *Triodia longiceps* over Low Isolated Clumps of Tussock Grasses to Low Closed Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* over Low Isolated Clumps of Sedges to Low Open Sedgeland of *Cyperus vaginatus* on brown sand, sandy loam and sandy clay in drainage lines associated with granite outcropping. **Area mapped (Proportion of Study Area):** 148.3 ha (2.31 %) **Sampling:** 19 quadrats (MCC-06, MCC-08, MCC-09, MCC-10, MCC-11, MCC-12, MCC-13, MCC-14, MCC-25, MCC-26, MCC-27, MCC-28, MCC-29, MCC-30, MCC-31, MCC-32, MCC-33, MCC-34, MCC-38 **Significant Taxa:** None recorded **Introduced Taxa:** *Aerva javanica, Argemone ochroleuca, Cenchrus ciliaris, Chloris barbata, Cynodon dactylon, Echinochloa colona, Malvastrum americanum, Sonchus oleraceus, Vachellia farnesiana* **Indicator Taxa:** *Alternanthera nana, Alysicarpus muelleri, Ammannia multiflora, Boerhavia gardneri, Boerhavia schomburgkiana, Centipeda minima subsp. macrocephala, Cyperus vaginatus, Dactyloctenium radulans, Eragrostis tenellula, Eriachne benthamii, Eucalyptus victrix, Euphorbia biconvexa, Euphorbia trigonosperma, Marsilea hirsuta, Stemodia grossa, Stemodia ?grossa* **Average Taxon Richness per Quadrat:** 40.1 ± 8.2	 **Plate 38: VT 15 (Quadrat MCC-33) (Photo: Woodman Environmental)**

5.2.4.3 Vegetation Condition Mapping

Table 19 presents the extent of each vegetation condition ranking mapped within each VT. The majority of the vegetation in super-group 1 (VTs 1 to 12) (McPhee Creek study area) were mapped as being in Excellent condition in 2012, with little to no disturbance and a relative absence of introduced flora taxa (Table 16; Appendix P). A few small areas had lower condition scores as a result of the presence of high densities of aggressive introduced species and high grazing and trampling impacts from cattle (Figure 14; Appendix P).

There were a number of quadrats in which introduced flora taxa were recorded where the vegetation condition was ranked as Excellent despite their presence (Quadrats MC021, MC042, MC047, MC051, MC057, MC066, MC067, MC107, MC111, MC113, MC129, MC135, MC142, MC148, MC150; Appendix P). These occurrences were of very low densities with the native vegetation structure intact, and therefore were not deemed to be having a significant impact at that time. In addition, the extent of such populations was not able to be readily determined from aerial photography, with resultant vegetation condition polygons likely to have been small. The application of a lower condition score to the entire vegetation type polygon for which the quadrat represented would have been inaccurate. These locations should be taken into consideration and reviewed prior to and during site works to prevent the spread of the introduced taxa to detrimental levels.

One area was mapped as Cleared (CL) in the McPhee Creek study area (Appendix O; Sheet O4), equivalent to the Marble-Bar-Nullagine Road. As stated in section 3.3, some clearing works have been undertaken since the original vegetation mapping was undertaken in the McPhee Creek Study Area. Clearing for exploration (drill lines) has targeted mainly in VTs 3a and 3b, with some impacts to VTs 4, 8b and 10. Upon inspection of the aerial photography, it is unlikely that any of the significant flora locations recorded during the surveys (April 2013) have been impacted by these works.

In 2013 the condition of vegetation of vegetation associated with super-group 2 (VTS 13 to 15) (Riparian study area) ranged from Very Good to Very Poor, with the majority classified as Good (Table 16; Appendix P). Factors influencing the vegetation condition were the presence of introduced species such as *Cenchrus ciliaris* (Buffel Grass) and high grazing and trampling impacts from cattle. Three areas had higher condition scores and were ranked as Very Good. Of these three areas, two areas were located on the southern discharge option and one was located on the middle discharge option (Appendix P).

The introduced weed species *Cenchrus ciliaris* was recorded in every quadrat established within the Riparian Study Area (39 quadrats) and had a percentage cover alive ranging from 1% to 90%. Other introduced species that were recorded regularly during the survey included *Echinochloa colona*, *Aerva javanica* and *Malvastrum americanum*, which had lower percentage alive cover in comparison to *Cenchrus ciliaris*.

Table 19: Extent of Vegetation Condition within Vegetation Types, McPhee Creek Compiled Study Area

VT	E	VG	G	P	VP	C
1	3148.4	-	-	-	-	-
2	135.6	-	2.9	-	-	-
3a	413.9	-	-	-	-	-
3b	74.1	-	-	-	-	-
4	24.1	-	-	-	-	-
5	147.1	-	-	-	-	-
6a	88.8	-	-	-	-	-
6b	59	-	-	-	-	-
7	301.3	5	24.1	-	-	-
8a	130.5	2.6		-	-	-
8b	2.6	-		-	-	-
9	331.8	-		-	-	-
10	495.7	-		-	-	-
11	447.9	-		-	-	-
12a	161.1	-		-	-	-
12b	53.8	-	0.4	-	-	-
13	-	5.6	112.1	42.9	26.6	-
14	-	-	29.6	2.9	9.2	-
15	-	16.5	102.4	17.1	12.2	-
C	-	-	-	-	-	1
Total	**6015.7**	**29.7**	**271.5**	**62.9**	**48**	**1**
Percentage	**93.6**	**0.5**	**4.2**	**1.0**	**0.7**	**0.02**

200000 205000 210000 215000

7620000 7615000 7610000 7605000 7600000 7595000

Legend

- McPhee Creek Compiled Study Area

Vegetation Condition

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

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Overview of Vegetation Condition of the McPhee Creek Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f14.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

14

5.2.4.4 Groundwater Dependent Vegetation

An assessment of the potential groundwater dependence of the vegetation through review of the phreatophytic nature of taxa known from the VTs has been undertaken, as presented in Table 20.

Table 20: Potential Groundwater Dependency of Vegetation Types in the Compiled Study Area

Vegetation Type	Phreatophyte Taxa Present
5	*Atalaya hemiglauca* – facultative (presumed)
6b	*Atalaya hemiglauca* – facultative (presumed)
7	*Atalaya hemiglauca* – facultative (presumed) *Melaleuca glomerata* – facultative (presumed) *Sesbania cannabina* – facultative (presumed; potentially obligate) *Eucalyptus victrix* – facultative (presumed)
13	*Atalaya hemiglauca* – facultative (presumed) *Eucalyptus camaldulensis* – obligate or facultative (known) *Eucalyptus victrix* – facultative (presumed) *Melaleuca glomerata* – facultative (presumed)
14	*Acacia ampliceps* – facultative (presumed) *Atalaya hemiglauca* – facultative (presumed) *Eucalyptus camaldulensis* – obligate or facultative (known) *Eucalyptus victrix* – facultative (presumed) *Melaleuca glomerata* – facultative (presumed) *Sesbania cannabina* – facultative (presumed; potentially obligate)
15	*Atalaya hemiglauca* – facultative (presumed) *Eucalyptus camaldulensis* – obligate or facultative (known) *Eucalyptus victrix* – facultative (presumed) *Melaleuca glomerata* – facultative (presumed) *Sesbania cannabina* – facultative (presumed; potentially obligate)

Six VTs have been identified which are at least occasionally characterised by taxa that are either known or presumed to be obligate or facultative phreatophytes, and as such have the potential to represent GDV.

The dominant phreatophytic taxon in the Pilbara is *Melaleuca argentea*, which is an obligate phreatophyte that will only occur if access to groundwater is available for at least part of the year (Graham 2001; cited in Department of Water 2010). Likewise, *Sesbania formosa* is also considered likely to be an obligate phreatophyte, as it is restricted to alluvial soils in rivers or major creeks, potentially indicating high groundwater use (Department of Water 2010). Neither of these taxa have been recorded in the McPhee Creek Compiled Study Area; however, *Sesbania cannabina* is known to occur in VTs 7, 14 and 15; this taxon occurs on sandy, clay and loamy soils; within creek and river beds, areas subjected to seasonal water-logging (WA Herbarium 1998-), and therefore has the potential to be phreatophytic.

Eucalyptus camaldulensis can be an obligate or facultative phreatophyte depending on the specific hydrological characteristics of a site (Department of Water 2010); in situations where groundwater is present close to the surface individuals can become reliant on this source. *Melaleuca glomerata*, *Atalaya hemiglauca*, *Acacia ampliceps* and *Melaleuca*

linophylla appear to generally be considered at least in part facultatively phreatophytic, primarily based on their presence in major river channels where groundwater is known to be close to the surface (Loomes 2010a, 2010b; Loomes and Braimbridge 2010).

Eucalyptus victrix is another species that has been suggested to be a facultative phreatophyte in some situations (AQ2, 2015; Eastham, 2015; Loomes and Braimbridge 2010; Loomes 2010a), however it is generally considered to be a vadophyte (AQ2, 2015). This is supported by Woodman Environmental's multi-year monitoring of vegetation considered at risk of impact from dewatering at Atlas's Pardoo minesite, east of Port Hedland; no impacts to health on this taxon were evidenced despite drawdown from a bore located in close proximity to a monitoring site. This taxon was recorded within the riparian study area in VTS 13, 14 and 15; it was also a component of VT 7, which was mapped on minor to major drainage lines within the Compiled Study Area. There is a slight risk that this taxon may represent areas of GDV if the groundwater is present within 10m of the surface.

It is highly unlikely that VTs 5 and 6b represent GDV: VT 5 was mapped on located on granite and ironstone outcropping on steep rocky slopes of gorges and cliff faces; likewise VT 6b was mapped on granite outcropping associated with very steep upper slopes on hills. The presence of *Atalaya hemiglauca* is very unlikely to indicate GDV in these areas. VT 7 was mapped on sandy loams to sandy clays on drainage lines and associated floodplains in the McPhee Creek study area; *Melaleuca glomerata* was not a dominant taxon anywhere in this VT, and it is more likely that the vegetation in these areas are more reliant on surface water than groundwater.

VTs 13, 14 and 15 are all associated with the creeklines of the Riparian Study Area, which would have access to surface water for at least part of the year after predominantly summer rainfall. *Eucalyptus camaldulensis* is present throughout these VTs and may be reliant on groundwater in these areas if the groundwater level is close to the surface (<10m from surface). Several quadrats had relatively high prevalence of *Melaleuca glomerata*, particularly quadrats associated with VT 15 (MCC-08; MCC-10; MC-14). It is possible that these areas are more reliant on groundwater. VTs 8a and 8b occur on a range of claypans and basins, either up on the range (VT 8b) or on lower plains (VT 8a); the vegetation composition of neither of these VTs are phreatophytic in nature. It is likely that they are reliant on surface water regimes.

Atlas have provided data in relation to the known areas of depth to groundwater within 10m of the topographical surface over the general area, including within the Compiled Study Area. Areas of the VTS as mentioned above where groundwater is available within 10m of the surface are more likely to contain GDV; groundwater available within this depth is known to be more likely to be available to vegetation, even if only used during high-stress times of the year (for example, in the dry months leading up to the wet season).

Table 21 presents the areas (ha) of each VT where the groundwater is known (through modelling conducted by Atlas Iron) to occur within 10m of the topographical surface, and an assessment of the likelihood of groundwater dependence of these VTs. Figure 15 presents the extent of groundwater within 10m of the topographical surface against the mapped VTs of the Compiled Study Area.

Table 21: Groundwater Dependence of the Vegetation Types of the Compiled Study Area

VT	Area (ha) GW <10m	Total Area of VT	Percentage Occurrence (GW <10m)	Presence of Phreatophytic taxa	Likelihood of GDV	Comment
1	335.1	3148.4	10.6		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
2	134.7	138.5	97.3		Unlikely	VT occurs on lower slopes of hills to undulating plains and associated outwash areas; the typical vegetation does not appear to have any phreatophytic characteristics, although most of the area has groundwater within 10m of surface. It is unlikely that the vegetation would be dependent upon the groundwater, consisting of isolated *Corymbia hamersleyana* and *Eucalyptus leucophloia* over shrubland of Acacia spp. over Triodia hummock grassland.
3a	0.0	413.9	0.0		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
3b	0.0	74.1	0.0		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
4	0.0	24.1	0.0		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
5	2.8	147.1	1.9	*	Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
6a	28.5	88.8	32.1		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
6b	4.3	59.0	7.3	*	Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
7	191.1	330.4	57.8	*	Potential (localised patches)	Although *Sesbania cannabina* was recorded in this VT, it was not widespread nor a dominant taxon in this VT. As a whole, the vegetation is more likely to be dependent upon surface water drainage. However, localised areas of potential GDV may be present where the groundwater naturally occurs within 10m of the surface (Figure 15).

VT	Area (ha) GW <10m	Total Area of VT	Percentage Occurrence (GW <10m)	Presence of Phreatophytic taxa	Likelihood of GDV	Comment
8a	99.8	133.0	75.0		Unlikely	Although the groundwater is within 10m of the surface across much of the area mapped as VT 8a, the vegetation is not characterised by phreatophytic taxa. VT 8a occurs on shallow basins and claypans, which are likely to be perched and not in contact with the groundwater below.
8b	0.0	2.6	0.0		Unlikely	VT 8b occurs on shallow basins and claypans, which are likely to be perched and not in contact with the groundwater below; in addition, the groundwater is not known to occur within 10m of the surface in these areas. These areas are unique in the fact they are situated at the top of a high range of hills, and in their species composition (including presence of *Operculina aequisepala*, which is typically associated with sandy drainage lines on lower lying plains) is unusual for these areas.
9	119.8	331.9	36.1		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
10	171.0	495.7	34.5		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
11	22.0	447.9	4.9		Unlikely	Typical vegetation not phreatophytic in nature; groundwater not typically with 10m of surface.
12a	148.3	161.1	92.0		Unlikely	Taxa present are not phreatophytic. VT mapped associated with clay-loam soils on flats and plains adjacent to the main range.
12b	52.1	54.2	96.1		Unlikely	Taxa present are not phreatophytic. VT mapped associated with calcrete areas, including low rises and hillocks in undulating plains.
13	164.8	187.2	88.0	*	Potential (localised patches)	The main upper stratrum tree layer was dominated by non-phreatophytic taxa; although *E. camaldulensis* occurred it did not dominate. However, the majority of the mapped area of this VT has access to groundwater, with no impeding layer as it occurs on sandy to sand loams on drainage lines. Potential GDV areas may be located where groundwater is within 10m of the ground surface.

VT	Area (ha) GW <10m	Total Area of VT	Percentage Occurrence (GW <10m)	Presence of Phreatophytic taxa	Likelihood of GDV	Comment
14	1.6	41.8	3.8	*	Potential (localised patches)	*E. camaldulensis* is a dominant taxon (some areas had dense cover), and *S. cannabina* and *M. glomerata* were also recorded; however, as the depth to groundwater is generally mapped at >10m throughout this VT, these patches could be localised only. Ephemeral pools were noted, and this VT was associated with sandy to clay substrates, which may indicate a reliance on surface water only. Potential GDV areas may be located where groundwater is within 10m of the ground surface.
15	145.3	148.3	98.0	*	Likely	There is a potential for GDV to occur through a combination of phreatophytic taxa and depth to groundwater being generally <10m from surface; however, this may be localised patches only, as sampled by areas where denser layers of taxa such as *Melaleuca glomerata,* or combinations of *E. camaldulensis, M. glomerata* and *S. cannabina* occur. This VT was associated an underlying granite substrate.

200000 205000 210000 215000

7620000 7615000 7610000 7605000 7600000 7595000

Legend

- McPhee Creek Compiled Study Area
- Groundwater within 10m

Vegetation Communities

- Likely GDV
- Potential GDV

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This map should only be used in conjunction with WEC report Atlas19-27-01.

Potential Groundwater Dependent Vegetation of the Compiled Study Area

Revision: 0- 29 August 2019

Author: Leah Firth

WEC Ref: Atlas19-27-01

Filename: Atlas19-27-01-f15.mxd

Scale: 1:100,000 (A3) Grid: MGA Zone 51

Figure

15

5.2.4.5 Significance of Vegetation

The DBCA - mapped 'Stony Saline Clay Plains of the Mosquito Land System' PEC 23 boundary includes the extreme southern section of the Riparian Study Area adjacent to the Nullagine River (Figure 12). The PEC boundary mapping provided as part of the desktop roughly matches with the extent of the Mosquito land system in this area, however only part of this land system identifies as being the PEC (stony saline plains).

This PEC is related to saline clay pans and flats which include halophytic species such as *Maireana melanocoma*, *Sclerolaena diacantha*, *Sclerolaena densiflora* and *Atriplex densiflora* (P1) as well as two endemic Acacia taxa, *Acacia aphanoclada* (P1) and *Acacia fecunda* (P3). VTs 13, 14 and 15 were mapped in the sections of the Compiled Study Area which overlap the DBCA PEC 23 boundary; none of these VTs represent the PEC description or have species composition similar to that presented above. The majority of these taxa were not recorded as occurring within the Compiled Study Area and no areas were mapped that were consistent with the features and full species composition of the PEC; therefore the VTs mapped within the Study Area are not considered representative of the PEC, despite part of the Study Area occurring within the mapped PEC boundary.

The presence of five plants of *Acacia aphanoclada* (P1) occurring on lowerslopes adjacent to the Study Area near Quadrat MCC-33 was not considered to represent PEC 23 as the other taxa recorded as characterising this PEC were not present. *Acacia aphanoclada* (P1) was not a dominant taxon in the area, and the other taxa surrounding this area were likewise not halophytic. Although the halophytic taxon *Sclerolaena densiflora* was recorded in VT 8a (McPhee Creek study area, not located in the DBCA mapped PEC 23 boundary), the other characteritsics of this VT (including location and other taxa present) do not represent this PEC.

No VTs within the Study Area are equivalent to any other state-listed TECs or PECs, or federal-listed TECs (DBCA 2018; 2019a; 2019c; DoE 2019).

The local and regional significance of the VTs mapped within the Compiled Study Area, as per the methods described in section 3.3.7, is presented in Table 22. Six VTs are considered to be locally significant; three are considered also to be potentially regionally significant. None of the VTs were characterised by the presence of significant flora taxa.

Table 22: Local and Regional Significance of Vegetation

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
1	48.97	Not locally significant • Not characterised by significant flora • Landforms/soil types on which VT occurs locally common and widespread; VT is not characterised by significant flora taxa	Not regionally significant • Grouped with regional quadrats into VT 14 as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including Mt Webber and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 14 as described at Corunna Downs was common (approximately one third of the mapped area). • Likely to be regionally common and widespread based on usual landform type
2	2.15	Not locally significant • Not characterised by significant flora • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Grouped with regional quadrats into VT 2 as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including Mt Webber and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 2 as described at Corunna Downs was however uncommon (0.5% of the mapped area), occurring on plains and low hills with granite influence. • Likely to to be regionally widespread although not common based on usual landform types and survey data.
3a	6.44	Not locally significant • Not characterised by significant flora • Landforms/soil types on which VT occurs locally common (ironstone on the range)	Not regionally significant • Grouped with regional quadrats into VT 16 as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including McPhee Creek and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 16 as described at Corunna Downs was not uncommon (10% of the mapped area), occurring on ironstone. • Not likely however to be regionally common, and would be restricted to ironstone influenced areas.

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
3b	1.15	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs is locally common (ironstone on the range)	Not regionally significant • Grouped with regional quadrats into 'VT 16' as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including McPhee Creek and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 16 as described at Corunna Downs was not uncommon (10% of the mapped area), occurring on ironstone. • Quadrats specific to VT 3b were grouped separately within 'VT16' to other regional quadrats; they grouped most similarly to quadrats forming McPhee VT 4 (below). • Although not regionally significant, VT 3b is not likely to be regionally common, and would be restricted to ironstone influenced areas.
4	0.37	**Locally significant** • Locally restricted (<1% of the Compiled Study Area); mapped on a locally restricted landform within the Compiled Study Area (Robe Land System)	Not regionally significant • Grouped with regional quadrats into 'VT 16' as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including McPhee Creek and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. 'VT 16' as described at Corunna Downs was not uncommon (10% of the mapped area), occurring on ironstone. • Quadrats specific to VT 4 were grouped separately within 'VT16' to other regional quadrats; they grouped most similarly to quadrats forming McPhee VT 3b. • However, VT 4 not likely to be regionally common, and would be restricted to ironstone influenced areas.
5	2.29	**Locally significant** • Not characterised by significant flora taxa • Although only moderately restricted in the study area, the landforms on which VT occurs are considered relatively locally restricted (steep rocky slopes, gorges, cliff faces)	**Potentially regionally significant** • Quadrats mainly grouped with regional quadrats into 'VT 7' as described by Woodman Environmental (2014e); that VT was noted as being known from several other areas in the region (including McPhee Creek), however known from few occurrences (8) that were small in size. One quadrat grouped with regional quadrats into 'VT 6' as described by Woodman Environmental (2014e); that VT was also described as being potentially regionally significant. • Potential regional significance due to small area mapped and relatively few locations known; it is likely to be regionally uncommon and restricted based on usual landform type.

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
6a	1.38	**Locally significant** • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally uncommon and restricted in the Compiled Study Area; mapped on a locally restricted landform within the Compiled Study Area (Robe Land System)	Not regionally significant • Grouped with regional quadrats into 'VT 14' (similar to VTs 1 above and 14b below) as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including Mt Webber and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 14 as described at Corunna Downs was common (approximately one third of the mapped area). • Not likely to be regionally common, and would be restricted to steep crests of ironstone influenced ranges.
6b	0.92	**Locally significant** • Not characterised by significant flora taxa • Mapped area of VT is restricted in size in the Compiled Study Area, the landforms/soil types on which the VT occurs are locally uncommon and restricted (steep upperslopes with granite)	Not regionally significant • Grouped with regional quadrats into 'VT 14' (similar to VTs 1 and 14a above) as described by Woodman Environmental (2014e); that VT was noted to occur from several other regional areas, from multiple occurrences (including Mt Webber and Corunna Downs). The vegetation descriptions and landforms are similar between both of these VTs. VT 14 as described at Corunna Downs was common (approximately one third of the mapped area). • Not likely to be regionally common, and would be restricted to steep crests of potentially ironstone or granite influenced ranges.
7	5.14	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Grouped with regional quadrats into 'VT 18' (as per data from Woodman Environmental (2014e). As this VT did not occur in the Corunna Downs study area it was not described in that report. These quadrats only grouped with others from the McPhee Creek riparian study area (VTs 13, 14, 15). This is itself not unusual, as major drainage features are not usually the target for such vegetation studies. • Possibly occurs outside Study Area; however not likely to be regionally common and widespread, given the landform type.
8a	2.07	**Locally significant** • Not characterised by significant flora taxa • Relatively restricted within the Compiled Study Area Landforms/soil types on which VT occurs are not known to be restricted	**Potentially regionally significant** • Quadrats from VT 8a grouped into 'VT 5' (analysis in Woodman Environmental 2014e; as this VT did not occur at Corunna Downs it was not described further in that report). The only quadrats to group into VT 5 were from McPhee Creek study area (VTs 8a and 8b only), and therefore regional distribution is presumed to be restricted. • Possibly occurs further outside the Study Area, however the landform upon which it occurs (claypans and basins) would be restricted.

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
8b	0.04	**Locally significant** • Not characterised by significant flora taxa • Landforms/soil types on which the VT occurs are locally uncommon and restricted (perched claypans on the main range) • Unique species composition, for example presence of *Operculina aequisepala*, a taxon associated with sandy drainage lines on lower lying plains.	**Potentially regionally significant** • Quadrats from VT 8b grouped into 'VT 5' (analysis in Woodman Environmental 2014e; as this VT did not occur at Corunna Downs it was not described further in that report). The only quadrats to group into VT 5 were from McPhee Creek study area (VTs 8a and 8b only), and therefore regional distribution is presumed to be restricted. • Possibly occurs further outside the Study Area, however the landform upon which it occurs (perched claypans on ranges) would be very restricted.
9	5.16	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Quadrats from VT 9 grouped into 'VTs 12' and '14' (as per Woodman Environmental 2014e). The vegetation of both of these VTs are similar to the description of VT 9. Both VTs 12 and 14 were noted to be extensive throughout the Corunna Downs study area (36.85 and 33.8% respectively), and were represented in other surveys (Mt Webber). • Likely to be regionally common and widespread based on usual landform type.
10	7.71	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Quadrats from VT 10 grouped mainly into 'VT 12' (as per Woodman Environmental 2014e). The vegetation of VT 10 is similar to the description of 'VT 12'. VT 12 was noted to be extensive throughout the Corunna Downs study area (36.85%), and was represented in quadrats from other surveys (Corunna Downs and Mt Webber). • Likely to be regionally common and widespread based on usual landform type.
11	6.97	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Quadrats from VT 11 grouped into 'VT 12' as described by Woodman Environmental (2014e). The vegetation of VT 11 is similar to the description of 'VT 12'. 'VT 12' was noted to be extensive throughout the Corunna Downs study area (36.85%), and was represented in quadrats from other surveys (Corunna Downs and Mt Webber). • Likely to be regionally common and widespread based on usual landform type.

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
12a	2.51	Not locally significant • Not characterised by significant flora taxa • Landforms/soil types on which VT occurs locally common and widespread	Not regionally significant • Quadrats from VT 12a grouped into 'VT 9' as described by Woodman Environmental (2014e). The vegetation of VT 12a is similar to the description of the vegetation of 'VT 9'. 'VT 9' was not widely mapped in the Corunna Downs study area, but is known from other multiple occurrences in the region including at Mt Webber. • Likely to be regionally fairly widespread based on the statistical analysis and usual landform type.
12b	0.84	Not locally significant • Not characterised by significant flora taxa • Although mapped area of VT is restricted in extent in the Compiled Study Area, the landforms/soil types on which the VT occurs are relatively locally common and widespread	Not regionally significant • Quadrats from VT 12b grouped into 'VT 10' as described by Woodman Environmental (2014e). The vegetation of VT 12b is similar to the description of vegetation of 'VT 10'. 'VT 10' was not widely mapped in the Corunna downs study area, but is known from other multiple occurrences in the region including at Mt Webber. • Likely to be regionally fairly widespread based on the statistical analysis and usual landform type.
13	2.91	Not locally significant • Not characterised by significant flora taxa • Landforms/soil type on which the VT occurs is not restricted	Not regionally significant • Grouped with regional quadrats into 'VT 18' as described by Woodman Environmental (2014e). As this VT did not occur in the Corunna Downs study area it was not described in that report. These quadrats only grouped with others from the McPhee Creek VTs 7, 14 and 15. This is itself not unusual, as major drainage features are not usually the target for such vegetation studies. • Possibly occurs outside Study Area; and would be widespread although no common, given the landform type.
14	0.65	Locally significant • Not characterised by significant flora taxa • Locally restricted within the Compiled Study Area, with characteristics such as ephemeral pools and areas of potential GDV, which are locally restricted and may provide refugia.	Not regionally significant • Grouped with regional quadrats into 'VT 18' as described by Woodman Environmental (2014e). As this VT did not occur in the Corunna Downs study area it was not described in that report. These quadrats only grouped with others from the McPhee Creek VTs 7, 13 and 15. This is itself not unusual, as major drainage features are not usually the target for such vegetation studies. • Possibly occurs outside Study Area; and would be widespread although no common, given the landform type.

Vegetation Type	Mapped Extent in Compiled Study Area (%)	Local Conservation Significance	Regional Conservation Significance
15	2.31	Not locally significant • Not characterised by significant flora taxa • Not locally restricted within the Compiled Study Area, however areas of potential GDV are of higher significance, as they may provide refugia.	Not regionally significant • Grouped with regional quadrats into 'VT 18' (as per data from Woodman Environmental (2014e). As this VT did not occur in the Corunna Downs study area it was not described in that report. These quadrats only grouped with others from the McPhee Creek VTs 7, 13 and 14. This is itself not unusual, as major drainage features are not usually the target for such vegetation studies. • Possibly occurs outside Study Area; and would be widespread although no common, given the landform type.

6. DISCUSSION

6.1 Flora of the Study Area

A total of 388 discrete vascular flora taxa and nine hybrids, representing 51 families and 165 genera, were recorded in the Compiled Study Area during the three surveys. The Compiled Study Area is considered to have moderate floristic diversity; this diversity is directly related to the variety of topographical, soil and landscape features sampled in the Compiled Study Area, as well as the relatively high intensity of sampling which was undertaken (all within appropriate timing for survey). Vegeation from landscape elements ranging from steep ironstone cliffs, to claypan and basin areas, to outwash areas influenced by granite, to relatively large drainage lines were sampled; this diversity in vegetation types has resulted in the moderate floristic diversity of the Compiled Study Area.

Four conservation significant (Priority) flora taxa were recorded during the 2012 and 2013 surveys. Although four other significant taxa are known to have been recorded in proximity to the Compiled Study Area (desktop review). One of these is a potential mid-identification (*Goodenia nuda* (P3)) and one other does not have suitable habitat in the Compiled Study Area (*Bulbostylis burbidgeae* (P3)). Two further significant flora taxa have the potential to occur in the Compiled Study Area but would most likely to be restricted to the Riparian study areas only due to their habitat preferences and known locations. The significance of the local populations of significant flora taxa known from the Compiled Study Area to their overall regional conservation are discussed below.

Acacia aphanoclada (P1) was recorded at three locations during the surveys, only one of which was directly within the Compiled Study Area. This location was determined to be on geology and soils which were atypical of the taxon and it is considered unlikely that further populations of this taxon are located within the Compiled Study Area, if present, it would only be represented by further isolated, small populations. Tthe populations recorded in the Compiled Study Area and surrounds are however considered significant populations: the Compiled Study Area forms the northern-most extent of its known range; the taxon has a restricted distribution; and relatively few populations are known, with most being represented by single records.

Eragrostis crateriformis (P3) was recorded in a relatively large number of locations, with considerable numbers of individuals, during searching within the Compiled Study Area. However, as an annual taxon, abundance is typically dependent upon environmental conditions such as seasonal rainfall, and populations may or may not persist in the originally recorded locations over time. In addition, the higher than average rainfall experienced in the region through January to April 2013 may have contributed to greater abundance of this taxon within the Compiled Study Area at the time of survey.

The local populations of *Eragrostis crateriformis* (P3) in the Compiled Study Area are not considered significant in terms of the overall conservation of the taxon. Although these populations are located near the eastern extent of its known range in Western Australia, it is known to occur further east within the Northern Territory, and is a taxon with a large known range. There are a significant number of known populations in Western Australia, at least two of which are located within conservation tenure (Millstream-Chichester National Park).

The populations of *Ptilotus mollis* (P4) in the Compiled Study Area are likewise not considered to be significant in terms of the overall conservation of the taxon. The Compiled Study Area is not located on the edge of its known range, and there are a high number of known populations, some of which occur on conservation estate. It was recorded in high numbers in VT 1, which is the most widespread of the VTs mapped in the Compiled Study Area.

Aerial photography interpretation suggests that immediately adjacent ranges are comprised of similar habitat suitable for supporting healthy populations. Observations outside of the Project Area show that this taxon extends to adjacent habitat beyond the McPhee Creek mining tenements, however abundance in these areas is not accurately known due to the level of survey conducted outside the original project boundary. Several populations were also identified immediately west of the Compiled Study Area during surveys of a proposed rail corridor (Woodman Environmental 2014c). Numerous populations of *Ptilotus mollis* (P3) were also recorded during previous studies further to the west in the vicinity of Mt Webber (Woodman Environmental 2012). It is possible that a broader census of populations of *Ptilotus mollis* outside the Compiled Study Area may show regional abundance to be similar to that observed within the tenements during the April 2013 survey.

The local populations of *Rostellularia adscendens* var. *latifolia* (P3) are also not considered significant to the conservation of the taxon; a large number of populations over a widespread range are known, with the Compiled Study Area located within this range; it is also known from conservation estate. The low number of recorded locations of this taxon is most likely a result of the lack of targeted survey within the Riparian study area; the preferred habitat of this taxon includes rocky drainage areas, and it is more likely to be widespread in and surrounding VTs 13, 14 and 15. Likewise, only one record was returned from VT 7, however targeted survey did include most of this VT and therefore its distribution within the McPhee Creek study area is not likely to be more widespread.

A relatively high number of introduced (weed) taxa are known to occur in the Compiled Study Area (15 taxa), nine of which have been ranked as having a high ecological impact and invasiveness ranking of rapid (Table 17). *Aerva javanica* (Kapok), *Cenchrus ciliaris* (Buffel Grass) and *Cenchrus setiger* (Birdwood Grass) are particularly invasive weeds, having the ability to spread into undisturbed native vegetation, and are particularly adept at colonising recently disturbed areas. The majority of locations were associated with drainage lines and similar features, predominantly in the Riparian study area, however also in VT 7 and surrounds in the McPhee Creek study area. *Aerva javanica* was the main weed species recorded in non-drainage areas.

6.2 Vegetation of the Study Area

Fifteen VTs (including four VTs being split into two subgroups each) were mapped in the Compiled Study Area, from two super-groups. The split between the two super-groups is based primarily on topographical location and the water-retention capacity of the landforms and associated soils, with distinct differences in species composition between the super-groups.

The diversity of VTs in super-group 1 (VTs 1 – 12) is considered to be moderate, with a reasonable variety of topographical features and soil types within the Compiled Study Area accounting for this diversity. However many VTs within each super-group are floristically similar, an indication of the repetitiveness and uniformity of particular topographical units. None of the VTs recorded in the Study Area represent any known TECs or PECs.

Super-group 2 (VTs 13 to 15) are likewise floristically similar, characterised by a suite of species that prefer this habitat type, including *Eucalyptus victrix, Eucalyptus camaldulensis, Acacia* species and *Atalaya hemiglauca* with mixed species typical of drainage lines over an understory of *Triodia longiceps* and *Cyperus vaginatus.* The similarity of the floristics within each VT gives an indication of the uniformity of the drainage lines, although the structure of the vegetation of each VT varied depending on location and water retention capabilities of the drainage lines. These VTs were similar to VT 7 (mapped on drainage lines in the McPhee Creek study area), however differences in the species composition can be attributed to the differences in the substrates, soils (including water-retention capability) and topography upon which they occur.

The effects of historical burning and timing of burns has possibly had an effect on the vegetation composition of some areas of the Compiled Study Area. Higher frequency and density of fire-responsive taxa in burnt areas in comparison to similar unburnt areas may have affected the floristic analysis. Evidence of fire history would suggest fire events occurring around three years prior to mapping of VTs 1 to 12, and it was estimated that previous fire events were greater than five years for VTs 13 to 15. Burn patterns also made interpretation of vegetation patterns on aerial photographs difficult over some parts of the Compiled Study Area. Therefore, confidence in the accuracy of mapping over these areas is lower compared to areas where it was of uniform fire age. However, fire is a natural and wide-spread phenomenon in the Pilbara region, and such burn history is not an unusual scenario specific to the McPhee Creek area. It is considered that mapping was adequate and suitable for use in the Impact Assessment process for the Project.

The VTs which may have some areas of groundwater dependence have been identified as those occurring in the Riparian study area (VTs 13, 14, 15). This is due to the presence of areas where both obligate and facultative phreatophytic taxa (*Eucalyptus camaldulensis*, *Melaleuca glomerata* and *Sesbania cannabina*) occur in higher densities, as well as the known depth to groundwater being within 10m of the surface. It must be noted that *Melaleuca argentea* was not recorded at any location in the Compiled Study Area; this known obligate phreatophyte assures groundwater dependence. The three areas containing the claypans on the main range (VT 8b) are most likely to be surface water dependent. They are unique in the fact they are situated top of a high range of hills, and in their species composition, particularly the presence of *Operculina aequisepala*, a taxon typically associated with sandy drainage lines on lower lying plains. However, the vegetation in these areas would be reliant on the natural surface water regime, occurring on perched claypans.

The Compiled Study Area falls within the buffer of the Mosquito Creek PEC 23 which is comprised of 'Stony Saline Clay Plains of the Mosquito Land System'. No areas within the Compiled Study Area were found to represent this PEC. Although VT 8a showed minor correlation to the 'Stony saline clay plains of the Mosquito Land System' PEC (presence of

one typical species), and a single plant of *Acacia aphanoclada* (P1) occurs high in the landscape in VT 1, these areas were not considered to represent the PEC. Likewise, VTs 13, 14 and 15 which are mapped within the PEC 23 boundary do not constitute the vegetation characteristic of this PEC. The vegetation otherwise does not represent any listed TECs or PECs, at state or commonwealth levels.

Most VTs were relatively widespread and common in the Compiled Study Area and were considered not to be of local conservation significance. However, six VTs were considered to be of local conservation significance, due to a combination of restricted mapped areas within the Compiled Study Area, and restricted nature of the soils and landforms which they occur on (VTs 4, 5, 6a, 6b, 8a, 8b). Of these, VTs 5, 8a and 8b are also considered to be potentially regionall significant; VT 5 was noted to be known from relatively few regional locations, and VTs 8a and 8b were not known to be representative of any other VTs mapped by Woodman Environmental in the region. In addition, all three of these VTs occur on landforms and soil types which are regionally restricted.

The condition of the majority of vegetation in the Study Area was ranked 'Excellent', with limited grazing and trampling impacts from stock noted, and few introduced taxa recorded at low levels of abundance. However a number of drainage features were ranked as 'Very Good' or 'Good', as these areas often displayed obvious signs of impact as a result of grazing and trampling from cattle, and also often contained one or more introduced flora taxa, particularly the invasive *Cenchrus ciliaris* (Buffel Grass) and *Aerva javanica* (Kapok), at moderate to high levels of abundance. Two small areas near the entrance of the minesite access road also received lower condition scores (Good) as a result of human disturbance.

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Appendix A: Definitions, Categories and Criteria for Threatened and Priority Ecological Communities (DBCA 2013a)

1. GENERAL DEFINITIONS

Ecological Community: A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (eg. substrate and topography), and the biotic factors.

Occurrence: a discrete example of an ecological community, separated from other examples of the same community by more than 20 metres of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

Adequately Surveyed is defined as follows:
"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

Community structure is defined as follows:
"The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (eg. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, eg. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of Modification and Destruction of an ecological community:
Modification: "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

Destruction: "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:
"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES

Presumed Totally Destroyed (PD)
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

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

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

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

Critically Endangered (CR)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

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

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

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

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

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

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

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

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

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

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

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

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

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

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

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

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

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet

been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

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

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

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

3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES PRIORITY ECOLOGICAL COMMUNITY LIST

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

Priority One: Poorly-known ecological communities:

Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities:

Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more

localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities:

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

(ii) Communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;

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

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

Priority Four: Ecological communities:

Communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

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

(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.

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

Priority Five: Conservation Dependent ecological communities:

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

Current as of January 2013

Appendix B: Conservation Codes for Western Australian Flora and Fauna (DBCA 2019a)

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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 *Biodiversity Conservation Act 2016.*

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened species

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

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

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

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

CR Critically endangered species

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN Endangered species

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife*

Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

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

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

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

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

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

Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Priority 4: Rare, Near Threatened and other species in need of monitoring

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Notes:
[1] The definition of flora includes algae, fungi and lichens
[2]Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Last updated 3 January 2019

Appendix C: Results of Search of the Department of the Environment and Energy Database with Regard to Environmental Matters of National Significance (DoEE 2019)

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

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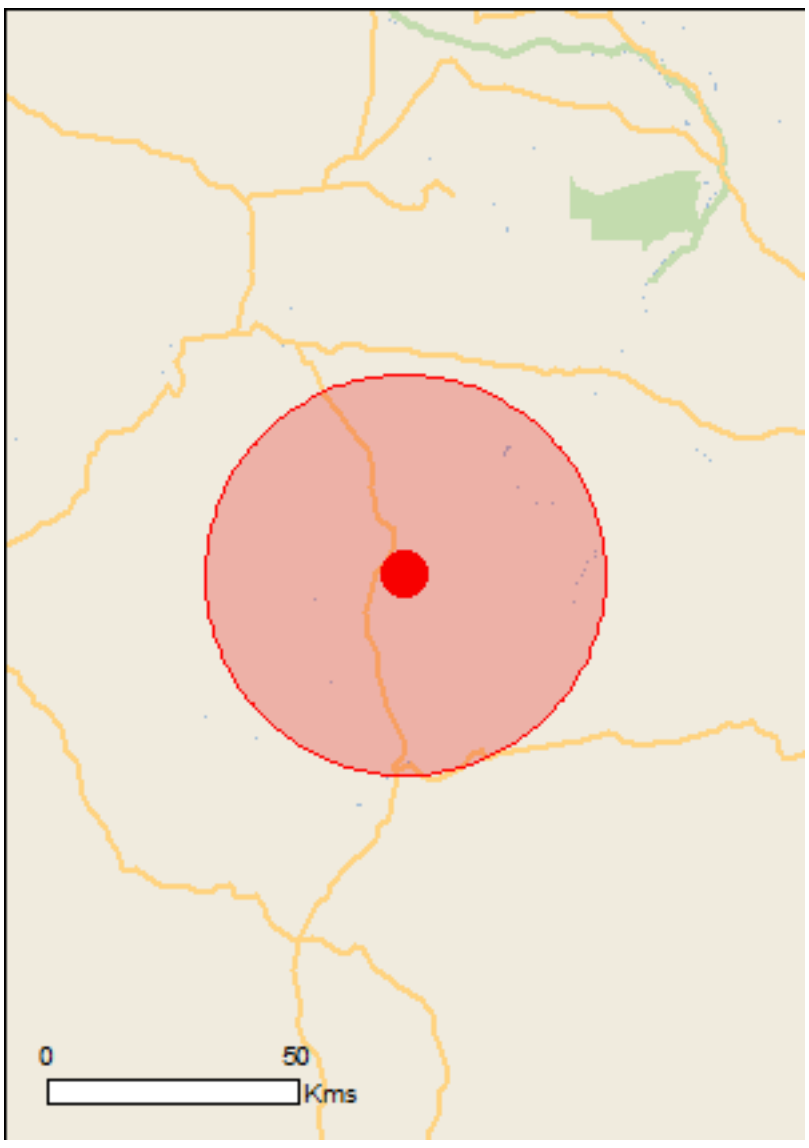

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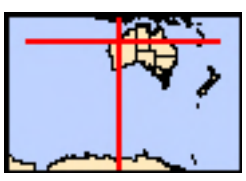

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	9
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Roosting known to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Meenthena Station	WA

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-21.56737 120.13088

Acknowledgements

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

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

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

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

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Appendix D: Vegetation Condition Scale for the Eremaean and Northern Botanical Provinces (EPA 2016a)

Condition Ranking	Description
E (Excellent)	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
VG (Very Good)	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
G (Good)	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
P (Poor)	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
VP (Very Poor)	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
D (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.

Appendix E: Vascular Plant Taxa Recorded in the McPhee Creek Compiled Study Area

Family	Taxon
Acanthaceae	*Dicladanthera forrestii*
	Dipteracanthus australasicus subsp. *australasicus*
	Rostellularia adscendens var. *latifolia*
Aizoaceae	*Trianthema triquetrum*
	Zaleya galericulata subsp. *galericulata*
Amaranthaceae	*Achyranthes aspera*
	**Aerva javanica*
	Alternanthera angustifolia
	Alternanthera nana
	Amaranthus cuspidifolius
	Amaranthus ?cuspidifolius
	Amaranthus undulatus
	Gomphrena canescens subsp. *canescens*
	Gomphrena cunninghamii
	Ptilotus aervoides
	Ptilotus astrolasius
	Ptilotus auriculifolius
	Ptilotus axillaris
	Ptilotus calostachyus
	Ptilotus clementii
	Ptilotus fusiformis
	Ptilotus helipteroides
	Ptilotus incanus
	Ptilotus macrocephalus
	Ptilotus mollis
	Ptilotus nobilis
	Ptilotus nobilis subsp. *nobilis*
	Ptilotus obovatus
Apocynaceae	*Carissa lanceolata*
	Marsdenia angustata
Araliaceae	*Trachymene oleracea*
	Trachymene oleracea subsp. *oleracea*
Asteraceae	*Centipeda minima* subsp. *macrocephala*
	**Flaveria trinervia*
	Minuria integerrima
	Pentalepis trichodesmoides subsp. *trichodesmoides*
	Peripleura virgata
	Pluchea dentex
	Pluchea ?dentex
	Pluchea ferdinandi-muelleri
	Pluchea rubelliflora
	Pluchea tetranthera
	Pterocaulon ?serrulatum
	Pterocaulon sp.

Family	Taxon
	Pterocaulon sphacelatum
	Pterocaulon ?sphaeranthoides
	**Sonchus oleraceus*
	Streptoglossa bubakii
	Streptoglossa liatroides
	Streptoglossa sp.
Boraginaceae	*Ehretia saligna* var. *saligna*
	Heliotropium chrysocarpum
	Heliotropium crispatum
	Heliotropium cunninghamii
	Heliotropium heteranthum
	Heliotropium inexplicitum
	Heliotropium pachyphyllum
	Heliotropium skeleton
	Heliotropium sp.
	Heliotropium tenuifolium
	Trichodesma zeylanicum var. *?zeylanicum*
Capparaceae	*Capparis spinosa* subsp. *nummularia*
Caryophyllaceae	*Polycarpaea corymbosa*
	Polycarpaea holtzei
	Polycarpaea longiflora
Celastraceae	*Stackhousia intermedia*
	Stackhousia ?intermedia
	Stackhousia muricata
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*
	Dysphania sphaerosperma
	Maireana melanocoma
	?Maireana sp.
	Rhagodia eremaea
	Salsola ?australis
	Salsola australis
	Sclerolaena cornishiana
	Sclerolaena costata
	Sclerolaena densiflora
Cleomaceae	*Cleome viscosa*
Commelinaceae	*Commelina ensifolia*
Convolvulaceae	*Bonamia ?erecta*
	Bonamia pilbarensis
	?Bonamia sp.
	Duperreya commixta
	Evolvulus alsinoides var. *decumbens*
	Evolvulus alsinoides var. *villosicalyx*
	Ipomoea muelleri
	Operculina aequisepala

Family	Taxon
	Polymeria ambigua
Cucurbitaceae	*Austrobryonia pilbarensis*
	**Citrullus amarus*
	Cucumis melo
	Cucumis variabilis
Cyperaceae	*Bulbostylis barbata*
	Cyperus cunninghamii subsp. *cunninghamii*
	Cyperus difformis
	?*Cyperus difformis*
	Cyperus ?iria
	Cyperus iria
	Cyperus ixiocarpus
	Cyperus vaginatus
	Fimbristylis dichotoma
	Fimbristylis ?dichotoma
	Fimbristylis microcarya
	Fimbristylis simulans
	?*Schoenoplectus laevis*
	Schoenoplectus subulatus
Elatinaceae	*Bergia pedicellaris*
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*
	Euphorbia australis
	Euphorbia biconvexa
	Euphorbia boophthona
	**Euphorbia hirta*
	Euphorbia schultzii
	Euphorbia tannensis subsp. *eremophila*
	Euphorbia trigonosperma
Fabaceae	*Acacia acradenia*
	Acacia adsurgens
	Acacia ampliceps
	Acacia ancistrocarpa
	Acacia aphanoclada
	Acacia bivenosa
	Acacia coriacea subsp. *pendens*
	Acacia eriopoda
	Acacia eriopoda x trachycarpa
	Acacia ?holosericea
	Acacia inaequilatera
	Acacia maitlandii
	Acacia monticola
	Acacia monticola x
	Acacia monticola x trachycarpa
	Acacia ?monticola x tumida var. *pilbarensis*

Family	Taxon
	Acacia monticola x tumida var. pilbarensis
	Acacia orthocarpa
	Acacia pruinocarpa
	Acacia ptychophylla
	Acacia pyrifolia var. *morrisonii*
	Acacia pyrifolia var. *pyrifolia*
	Acacia retivenea subsp. *clandestina*
	Acacia sp. (hybrid)
	Acacia synchronicia
	Acacia tenuissima
	Acacia trachycarpa
	Acacia trachycarpa x tumida var. pilbarensis
	Acacia tumida var. *pilbarensis*
	Acacia ?tumida x
	Aeschynomene indica
	Alysicarpus muelleri
	Cajanus cinereus
	Crotalaria medicaginea var. *neglecta*
	Crotalaria novae-hollandiae subsp. *novae-hollandiae*
	?*Crotalaria* sp.
	Cullen graveolens
	Cullen leucanthum
	Cullen leucochaites
	Desmodium muelleri
	Gastrolobium grandiflorum
	Glycine canescens
	Gompholobium oreophilum
	Indigastrum parviflorum
	Indigofera colutea
	Indigofera linifolia
	Indigofera linnaei
	Indigofera monophylla
	Indigofera rugosa
	Indigofera trita
	Isotropis atropurpurea
	Lotus australis
	Neptunia dimorphantha
	Neptunia ?dimorphantha
	Petalostylis labicheoides
	Rhynchosia minima
	Senna artemisioides subsp. *helmsii*
	Senna artemisioides subsp. *oligophylla*
	Senna artemisioides subsp. *oligophylla x ?symonii*
	Senna glutinosa subsp. *glutinosa*

Family	Taxon
	Senna glutinosa subsp. *pruinosa*
	Senna glutinosa subsp. *x luerssenii*
	Senna notabilis
	Senna symonii
	Senna symonii ?x
	Senna venusta
	Sesbania cannabina
	Swainsona decurrens
	Swainsona formosa
	Swainsona stenodonta
	Tephrosia rosea var. *clementii*
	Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)
	Tephrosia sp. Fortescue (A.A. Mitchell 606)
	Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)
	Tephrosia stipuligera
	Tephrosia virens
	**Vachellia farnesiana*
	Vigna lanceolata var. *lanceolata*
Goodeniaceae	*Dampiera candicans*
	Goodenia cusackiana
	Goodenia microptera
	Goodenia muelleriana
	Goodenia stobbsiana
	Goodenia triodiophila
	Scaevola amblyanthera var. *centralis*
	Scaevola browniana subsp. *browniana*
	Scaevola spinescens
Haloragaceae	*Haloragis gossei* var. *inflata*
Lamiaceae	*Clerodendrum tomentosum* var. *lanceolatum*
Lauraceae	*Cassytha capillaris*
Loranthaceae	*Amyema preissii*
	Amyema sanguinea var. *sanguinea*
Lythraceae	*Ammannia baccifera*
	Ammannia multiflora
Malvaceae	*Abutilon lepidum*
	Abutilon ?lepidum
	Abutilon macrum
	Abutilon malvifolium
	Abutilon oxycarpum subsp. Prostrate (A.A. Mitchell PRP 1266)
	Abutilon sp.
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)
	Androcalva luteiflora
	Corchorus lasiocarpus subsp. *lasiocarpus*
	Corchorus parviflorus

Family	Taxon
	Corchorus sp.
	Corchorus tridens
	Gossypium australe
	Gossypium robinsonii
	Hibiscus austrinus var. *austrinus*
	Hibiscus coatesii
	Hibiscus goldsworthii
	Hibiscus leptocladus
	?*Hibiscus* sp.
	Hibiscus sturtii var. *campylochlamys*
	Hibiscus sturtii var. *platychlamys*
	?*Keraudrenia* sp.
	**Malvastrum americanum*
	Melhania oblongifolia
	Seringia nephrosperma
	Sida ?*arenicola*
	Sida clementii
	Sida echinocarpa
	Sida fibulifera
	Sida aff. *fibulifera*
	Sida ?*macropoda (complex)*
	Sida rohlenae subsp. *rohlenae*
	Sida sp.
	Sida sp. Articulation below (A.A. Mitchell PRP 1605)
	Sida sp. Excedentifolia (J.L. Egan 1925)
	Sida sp. L (A.M. Ashby 4202)
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)
	Triumfetta chaetocarpa
	Triumfetta clementii
	Triumfetta maconochieana
	Waltheria indica
	Waltheria virgata
Marsileaceae	*Marsilea hirsuta*
Menispermaceae	*Tinospora smilacina*
Molluginaceae	*Trigastrotheca molluginea*
Moraceae	*Ficus brachypoda*
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*
	Corymbia ferriticola
	Corymbia ?*ferriticola*
	Corymbia hamersleyana
	Eucalyptus camaldulensis
	Eucalyptus leucophloia subsp. *leucophloia*
	Eucalyptus odontocarpa

Family	Taxon
	Eucalyptus victrix
	Melaleuca bracteata
	Melaleuca glomerata
Nyctaginaceae	*Boerhavia coccinea*
	Boerhavia gardneri
	Boerhavia ?repleta
	Boerhavia schomburgkiana
Oleaceae	*Jasminum didymum* subsp. *lineare*
Onagraceae	*Ludwigia perennis*
Papaveraceae	**Argemone ochroleuca*
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*
	Notoleptopus decaisnei
	Phyllanthus erwinii
	Phyllanthus exilis
	Phyllanthus maderaspatensis
Plantaginaceae	*Stemodia grossa*
	Stemodia ?grossa
Poaceae	*Amphipogon sericeus*
	Aristida contorta
	Aristida holathera var. *holathera*
	Aristida latifolia
	Bothriochloa ewartiana
	Brachyachne convergens
	**Cenchrus ciliaris*
	**Cenchrus setiger*
	**Chloris barbata*
	Chloris pectinata
	Chloris pumilio
	Chrysopogon fallax
	?Chrysopogon fallax
	Cymbopogon ambiguus
	Cymbopogon obtectus
	Cynodon convergens
	**Cynodon dactylon*
	Cynodon prostratus
	Dactyloctenium radulans
	Dichanthium sericeum subsp. *humilius*
	Digitaria brownii
	Digitaria ctenantha
	Diplachne fusca subsp. *fusca*
	**Echinochloa colona*
	Enneapogon caerulescens
	Enneapogon lindleyanus
	Enneapogon polyphyllus

Family	Taxon
	Enneapogon robustissimus
	Enteropogon ramosus
	Eragrostis crateriformis
	Eragrostis cumingii
	Eragrostis eriopoda
	Eragrostis leptocarpa
	Eragrostis setifolia
	Eragrostis sp.
	Eragrostis tenellula
	Eriachne benthamii
	Eriachne ciliata
	Eriachne lanata
	Eriachne mucronata
	Eriachne obtusa
	Eriachne pulchella subsp. *dominii*
	Eriochloa pseudoacrotricha
	Iseilema dolichotrichum
	Panicum decompositum
	Paraneurachne muelleri
	Paspalidium clementii
	Paspalidium tabulatum
	Perotis rara
	Schizachyrium fragile
	Setaria surgens
	**Setaria verticillata*
	Sorghum plumosum
	Sporobolus australasicus
	Themeda avenacea
	Themeda triandra
	Tragus australianus
	Triodia angusta
	Triodia brizoides
	Triodia epactia
	Triodia longiceps
	Triodia wiseana
	Tripogonella loliiformis
	Yakirra australiensis
Polygalaceae	*Polygala isingii*
Portulacaceae	*Portulaca oleracea*
	**Portulaca pilosa*
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*
	Grevillea wickhamii
	Grevillea wickhamii subsp. *hispidula*
	Hakea chordophylla

Family	Taxon
	Hakea lorea subsp. *lorea*
Pteridaceae	*Cheilanthes ?lasiophylla*
	Cheilanthes ?sieberi
Rubiaceae	*Oldenlandia crouchiana*
	Psydrax latifolia
	Synaptantha tillaeacea var. *tillaeacea*
Santalaceae	*Santalum lanceolatum*
Sapindaceae	*Atalaya hemiglauca*
	Dodonaea coriacea
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*
	Eremophila latrobei subsp. *glabra*
	Eremophila longifolia
Solanaceae	*Nicotiana benthamiana*
	Nicotiana ?occidentalis
	Nicotiana occidentalis subsp. *obliqua*
	Nicotiana sp.
	Solanum diversiflorum
	Solanum horridum
	Solanum phlomoides
	Solanum ?phlomoides
Typhaceae	*Typha domingensis*
Urticaceae	*?Parietaria cardiostegia*
	Parietaria cardiostegia
Violaceae	*Hybanthus aurantiacus*
Zygophyllaceae	*Tribulus hirsutus*
	Tribulus occidentalis
	Tribulus platypterus
	Tribulus suberosus

Appendix F: Raw Data Recorded within Quadrats in the McPhee Creek Compiled Study Area

GOVERNMENT AGENCY REFERENCE ONLY
NOT FOR PUBLIC DISSEMENTION
CONTAINS LOCATIONS OF SIGNIFICANT FLORA TAXA

Site Name:	MC002
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 203853E 7613552N
Landform Type:	Other, Plateau (other)
Slope Class:	Level (0 degrees)
Soil Type:	Clay Loam
Soil Colour:	Red Brown (other)
Rock Outcrop:	Marble (other), 2-10% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Marble (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	>5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Open Woodland of Corymbia hamersleyana and Corymbia ?ferriticola (8m, 6%)
Upper Stratum 2:	Low Isolated Trees of Eucalyptus leucophloia subsp. leucophloia (5m, 1%)
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Grevillea wickhamii subsp. hispidula (2.5m, 3%)
Lower Stratum 1:	Low Hummock Grassland of Triodia epactia (0.3m, 55%)
Lower Stratum 2:	Low Isolated Clumps of Shrubs of Acacia ptychophylla (0.3m, 2%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.7	0.1
Acacia eriopoda	0.8	0.1
Acacia inaequilatera	1.5	0.4
Acacia ptychophylla	0.3	2
Acacia tenuissima	1.2	0.1
Corchorus parviflorus	0.3	0.1
Corymbia ?ferriticola	8	2
Corymbia hamersleyana	8	4
Eriachne ciliata	0.1	0.1
Eriachne mucronata	0.4	0.2
Eucalyptus leucophloia subsp. *leucophloia*	5	1
Fimbristylis dichotoma	0.1	2
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.3	0.1
Goodenia triodiophila	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	2.5	3
Hakea chordophylla	3	0.5
Indigofera monophylla	0.3	0.3
Peripleura virgata	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Polygala isingii	0.1	0.1

Ptilotus calostachyus	0.3	0.1
Schizachyrium fragile	0.1	0.3
Senna glutinosa subsp. *glutinosa*	1.2	0.2
Senna glutinosa subsp. *pruinosa*	0.3	0.1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.2	0.1
Stackhousia intermedia	0.2	0.1
Triodia epactia	0.3	55

PHOTO

Site Name:	MC003
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 203569E 7613382N
Landform Type:	Crest
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	S
Soil Type:	Clay Loam
Soil Colour:	Brown
Rock Outcrop:	Ironstone, 10-20% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	Drill pad partly within quadrat (other)
Fire:	>5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Clumps of Trees of Corymbia hamersleyana (6m, 1%)
Mid Stratum 1:	Tall Shrubland of Acacia monticola and Grevillea wickhamii subsp. hispidula (3m, 30%)
Mid Stratum 2:	Mid Isolated Clumps of Shrubs of Gompholobium oreophilum (1m, 4%)
Lower Stratum 1:	Low Isolated Clumps of Shrubs of Acacia ptychophylla, Dampiera candicans (0.8m, 5%)
Lower Stratum 2:	Low Open Hummock Grassland of Triodia epactia (0.3m, 20%) and Low Open Tussock Grassland of Eriachne lanata (0.4m, 20%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia eriopoda	1.2	0.1
Acacia monticola	3	25
Acacia monticola x	0.8	0.1
Acacia ptychophylla	0.3	3
Amphipogon sericeus	0.2	0.1
Bonamia pilbarensis	0.1	0.1
Corchorus parviflorus	0.4	0.1
Corymbia hamersleyana	6	1
Dampiera candicans	0.8	2
Dodonaea coriacea	1	0.2
Eriachne ciliata	0.1	0.1
Eriachne lanata	0.4	20
Eriachne mucronata	0.2	0.1
Eriachne pulchella subsp. *dominii*	0.1	0.1
Fimbristylis simulans	0.1	0.1
Gompholobium oreophilum	1	4
Goodenia stobbsiana	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	3	5
Hibiscus sturtii var. *campylochlamys*	0.3	0.1

Hybanthus aurantiacus	0.1	0.1
Paraneurachne muelleri	0.3	0.1
Polycarpaea holtzei	0.1	0.1
Ptilotus calostachyus	0.6	0.1
Seringia nephrosperma	1.2	0.3
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	2	0.2
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.2	0.1
Tephrosia rosea var. *clementii*	1.2	0.1
Triodia epactia	0.3	20
Triumfetta maconochieana	0.4	0.1

PHOTO

Site Name:	MC004
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 203459E 7613054N
Landform Type:	Crest
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	ESE
Soil Type:	Clay Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	Ironstone, 10-20% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	>5y

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Woodland of Eucalyptus leucophloia subsp. leucophloia (6m, 15%), ,
Mid Stratum 1:	Tall Open Shrubland of Acacia monticola (3m, 20%)
Mid Stratum 2:	Mid Isolated Clumps of Shrubs of Gompholobium oreophilum and Senna glutinosa subsp. glutinosa (1.8m, 2%)
Lower Stratum 1:	Low Open Shrubland of Acacia ptychophylla and Dampiera candicans (0.6m, 11%)
Lower Stratum 2:	Low Hummock Grassland of Triodia epactia (0.4m, 40%) and Low Sparse Tussock Grassland of Eriachne mucronata (0.3m, 8%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia monticola	3	20
Acacia ptychophylla	0.3	1
Acacia tumida var. *pilbarensis*	1.2	0.2
Amphipogon sericeus	0.1	0.1
Bonamia pilbarensis	0.1	0.1
Corymbia ?ferriticola	1	0.3
Corymbia hamersleyana	2.5	0.5
Cymbopogon ambiguus	0.4	0.1
Cyperus cunninghamii subsp. *cunninghamii*	0.2	0.1
Dampiera candicans	0.6	10
Eriachne lanata	0.3	0.1
Eriachne mucronata	0.3	8
Eucalyptus leucophloia subsp. *leucophloia*	6	15
Fimbristylis simulans	0.1	0.1
Gompholobium oreophilum	1	1
Goodenia stobbsiana	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	2	0.5
Hibiscus sturtii var. *campylochlamys*	0.2	0.1
Indigofera monophylla	0.4	0.3

Polycarpaea holtzei	0.1	0.1
Ptilotus calostachyus	0.4	0.1
Senna glutinosa subsp. *glutinosa*	1.8	1
Senna symonii	0.4	0.7
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	0.5	0.1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.2	0.1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.4	0.2
Trigastrotheca molluginea	0.1	0.1
Triodia epactia	0.4	40
Triumfetta maconochieana	0.2	0.1

PHOTO

Site Name:	MC006
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	22/05/2012
GPS Location:	WGS84 Zone 51 204807E 7613056N
Landform Type:	Midslope with undulating gully (other)
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	NW
Soil Type:	Clay Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	Granite, 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	>5y

DOMINANT TAXA IN VEGETATION STRATA

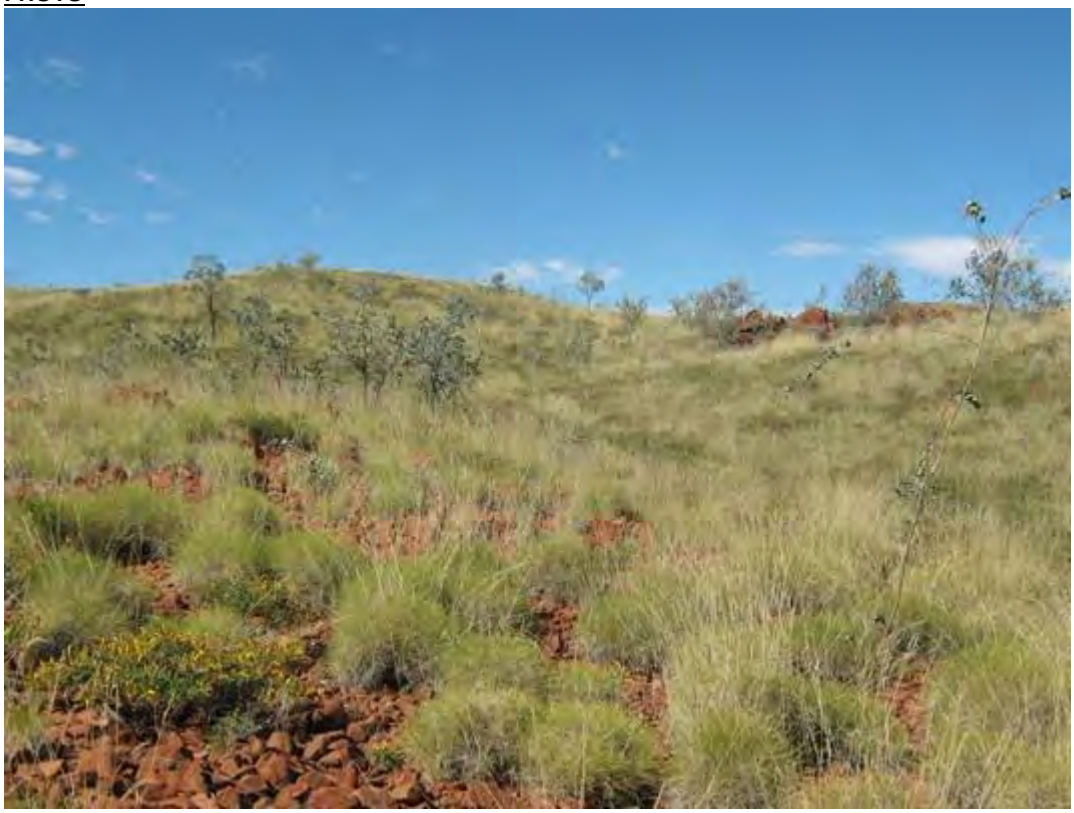
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Acacia inaequilatera, Acacia pyrifolia var. morrisonii and Grevillea wickhamii (3.5m, 1.3%)
Lower Stratum 1:	Low Shrubland of Acacia ptychophylla (0.4m, 40%)
Lower Stratum 2:	Mid Hummock Grassland of Triodia epactia (0.6m, 50%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia inaequilatera	3.5	0.6
Acacia ptychophylla	0.4	40
Acacia pyrifolia var. *morrisonii*	3	0.2
Aristida contorta	0.4	0.1
Boerhavia gardneri		0.1
Bonamia pilbarensis		0.1
Cleome viscosa	0.3	0.1
Corchorus parviflorus	0.3	0.1
Corymbia hamersleyana	0.4	0.1
Cymbopogon ambiguus	1	0.1
Dodonaea coriacea	0.3	0.1
Eriachne mucronata	0.6	0.1
Eucalyptus leucophloia subsp. *leucophloia*	2.5	0.1
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.2	0.1
Goodenia triodiophila	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	2	0.5
Heliotropium tenuifolium	0.3	0.1
Indigofera monophylla	0.5	0.1
Isotropis atropurpurea	0.5	0.1
Polycarpaea holtzei	0.1	0.1
Polygala isingii	0.1	0.1
Ptilotus calostachyus	1	0.1

Ptilotus incanus	0.2	0.1
Senna glutinosa subsp. *glutinosa*	0.6	0.1
Senna glutinosa subsp. *pruinosa*	1	0.1
Senna symonii	0.6	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Trachymene oleracea subsp. *oleracea*	0.3	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia epactia	0.6	50
Triodia wiseana	0.4	1
Tripogonella loliiformis	0.2	0.1

PHOTO



Site Name:	MC007
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	22/05/2012
GPS Location:	WGS84 Zone 51 205461E 7612909N
Landform Type:	Drainage Line
Slope Class:	Very Gently Inclined (1 degree)
Soil Type:	Sandy Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	No bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	>5y

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia hamersleyana (4.5m, 0.5%)
Mid Stratum 1:	Tall Shrubland of Acacia acradenia, A. inaequilatera, A. tumida var. pilbarensis, Ehretia saligna var. saligna and Grevillea wickhamii subsp. hispidula (8m, 42%)
Mid Stratum 2:	Mid Open Shrubland of Acacia bivenosa, A. pyrifolia var. pyrifolia and Senna glutinosa subsp. glutinosa (2m, 13%)
Lower Stratum 1:	Low Isolated Clumps of Shrubs of Corchorus parviflorus and Indigofera monophylla (0.5m, 5%)
Lower Stratum 2:	Low Open Hummock Grassland of Triodia epactia (0.4m, 20%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia acradenia	3	10
Acacia bivenosa	2	5
Acacia inaequilatera	8	1
Acacia orthocarpa	1.8	0.1
Acacia pyrifolia var. *pyrifolia*	1	5
Acacia tumida var. *pilbarensis*	5	20
Boerhavia gardneri	0.3	0.1
Bulbostylis barbata	0.1	0.1
Carissa lanceolata	1.2	0.1
Chrysopogon fallax	0.5	0.1
Cleome viscosa	0.1	0.1
Corchorus lasiocarpus subsp. *lasiocarpus*	0.3	0.1
Corchorus parviflorus	0.5	3
Corymbia hamersleyana	4.5	0.5
Crotalaria medicaginea var. *neglecta*	0.3	0.1
Cucumis variabilis		0.1
Cymbopogon ambiguus	0.5	0.2
Ehretia saligna var. *saligna*	2.5	1
Enneapogon lindleyanus	0.2	0.1
Eriachne mucronata	0.3	1

Euphorbia australis	0.1	0.1
Euphorbia tannensis subsp. *eremophila*	0.3	0.1
Euphorbia trigonosperma	0.3	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Goodenia muelleriana	0.2	0.1
Goodenia stobbsiana	0.2	0.1
Gossypium australe	0.4	0.1
Grevillea wickhamii subsp. *hispidula*	5	10
Hibiscus coatesii	0.2	0.1
Hibiscus sturtii var. *campylochlamys*	0.2	0.1
Hybanthus aurantiacus	0.2	0.1
Indigofera colutea	0.1	0.1
Indigofera monophylla	0.5	2
Indigofera rugosa	0.4	0.1
Isotropis atropurpurea	0.3	0.1
Jasminum didymum subsp. *lineare*		0.1
Phyllanthus maderaspatensis	0.3	0.1
Polycarpaea longiflora	0.2	0.1
Polymeria ambigua		0.1
Ptilotus calostachyus	0.6	0.1
Ptilotus nobilis	0.3	0.1
Rhynchosia minima		0.1
Santalum lanceolatum	1.8	0.1
Senna glutinosa subsp. *glutinosa*	1.5	3
Senna glutinosa subsp. *pruinosa*	0.8	0.2
Senna symonii	0.7	0.1
Sida echinocarpa	0.5	0.1
Sida rohlenae subsp. *rohlenae*	0.4	0.5
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.4	0.1
Solanum horridum	0.2	0.1
Tephrosia rosea var. *clementii*	0.3	0.1
Trichodesma zeylanicum var. ?*zeylanicum*	0.2	0.1
Triodia epactia	0.4	20
Triodia wiseana	0.3	0.5
Triumfetta clementii	0.1	0.1
Waltheria virgata	0.5	0.1

PHOTO

Site Name:	MC008
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	22/05/2012
GPS Location:	WGS84 Zone 51 205311E 7613831N
Landform Type:	Mid Slope
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	E
Soil Type:	Sandy Loam
Soil Colour:	Brown
Rock Outcrop:	Weathered Granite (other), 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Decayed/weathered granite (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	>5y

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia hamersleyana (5m, 0.1%)
Mid Stratum 1:	Tall Isolated Shrubs of Acacia inaequilatera, A. orthocarpa and A. pyrifolia var. morrisonii (3.5m, 0.3%)
Lower Stratum 1:	Mid Hummock Grassland of Triodia brizoides and T. epactia (0.5m, 60%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.5	0.1
Acacia inaequilatera	3.5	0.1
Acacia orthocarpa	2.5	0.1
Acacia pyrifolia var. *morrisonii*	1.8	0.1
Bonamia pilbarensis		0.1
Corchorus lasiocarpus subsp. *lasiocarpus*	0.4	0.1
Corchorus parviflorus	0.2	0.1
Corymbia hamersleyana	5	0.1
Dampiera candicans	0.5	0.1
Dodonaea coriacea	0.6	0.1
Eriachne mucronata	0.6	0.1
Goodenia stobbsiana	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	0.6	0.1
Hakea lorea subsp. *lorea*	0.3	0.1
Heliotropium tenuifolium	0.2	0.1
Indigofera monophylla	0.4	0.1
Isotropis atropurpurea	0.2	0.1
Ptilotus calostachyus	1	0.1
Senna symonii	0.5	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia brizoides	0.4	35

Triodia epactia	0.5	25
Triodia wiseana	0.4	0.2

PHOTO

Site Name:	MC009
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	22/05/2012
GPS Location:	WGS84 Zone 51 205639E 7613844N
Landform Type:	Upper Slope
Slope Class:	Very Steep (37 degrees)
Aspect:	S
Soil Type:	Sandy Loam
Soil Colour:	Brown
Rock Outcrop:	Granite, 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	approx. 3 - 4 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Clumps of Trees of Eucalyptus leucophloia subsp. leucophloia (3m, 1.5%)
Lower Stratum 1:	Mid Hummock Grassland of Triodia brizoides and T. epactia (0.5m, 60%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0.4	0.1
Acacia bivenosa	0.5	0.1
Acacia inaequilatera	1.2	0.1
Acacia ptychophylla	0.4	0.1
Acacia pyrifolia var. *morrisonii*	2	0.1
Boerhavia gardneri		0.1
Bonamia pilbarensis		0.1
Bulbostylis barbata	0.1	0.1
Clerodendrum tomentosum var. *lanceolatum*	0.5	0.1
Corchorus parviflorus	0.6	0.1
Corymbia hamersleyana	0.5	0.1
Crotalaria medicaginea var. *neglecta*	0.2	0.1
Cymbopogon ambiguus	1.2	0.1
Eriachne mucronata	0.4	0.2
Eucalyptus leucophloia subsp. *leucophloia*	3	1.5
Euphorbia boophthona	0.2	0.1
Euphorbia trigonosperma	0.1	0.1
Goodenia cusackiana	0.1	0.1
Goodenia stobbsiana	0.2	0.1
Goodenia triodiophila	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	1.5	0.1
Hakea lorea subsp. *lorea*	0.5	0.1
Heliotropium tenuifolium	0.3	0.1
Hibiscus coatesii	0.2	0.1
Hibiscus sturtii var. *campylochlamys*	0.2	0.1

Hybanthus aurantiacus	0.1	0.1
Indigofera monophylla	0.4	0.1
Isotropis atropurpurea	0.3	0.1
Paspalidium clementii	0.1	0.1
Peripleura virgata	0.2	0.1
Polycarpaea holtzei	0.1	0.1
Polygala isingii	0.1	0.1
Pterocaulon sp.	0.2	0.1
Ptilotus calostachyus	1	0.1
Senna glutinosa subsp. *glutinosa*	0.8	0.1
Senna glutinosa subsp. *x luerssenii*	0.6	0.1
Senna notabilis	0.2	0.1
Senna symonii	0.6	0.1
Sida echinocarpa	0.3	0.1
Sida rohlenae subsp. *rohlenae*	0.1	0.1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.4	0.1
Solanum horridum	0.1	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Tephrosia stipuligera	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia brizoides	0.4	55
Triodia epactia	0.5	5
Triumfetta clementii	0.3	0.1

PHOTO

Site Name:	MC010
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	11/05/2012
GPS Location:	WGS84 Zone 51 198490E 7610148N
Landform Type:	swale between two large hills (other)
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	SE
Soil Type:	Sandy Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	Granite, <2% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia (7m, 6%)
Mid Stratum 1:	Mid Isolated Clumps of Shrubs of Acacia inaequilatera and A. bivenosa (1.5m, 3%)
Mid Stratum 2:	Low Isolated Clumps of Shrubs of Acacia ptychophylla and Indigofera monophylla (0.3m, 5%)
Lower Stratum 1:	Low Hummock Grassland of Triodia brizoides and T. epactia (0.3m, 60%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	1.5	2
Acacia inaequilatera	1.5	1
Acacia monticola	1	0.1
Acacia ptychophylla	0.3	2
Aristida contorta	0.1	0.1
Bonamia pilbarensis	0.1	0.1
Corchorus parviflorus	0.3	0.3
Eucalyptus leucophloia subsp. *leucophloia*	7	6
Fimbristylis dichotoma	0.1	0.1
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.1	0.3
Goodenia triodiophila	0.4	0.1
Grevillea wickhamii subsp. *hispidula*	1	0.1
Heliotropium skeleton	0.3	0.1
Hibiscus coatesii	0.3	0.1
Hibiscus sturtii var. *campylochlamys*	0.1	0.1
Indigofera monophylla	0.3	3
Isotropis atropurpurea	0.3	0.1
Pterocaulon ?sphaeranthoides	0.1	0.1
Ptilotus calostachyus	0.4	0.2
Senna glutinosa subsp. *glutinosa*	1	0.5

Senna symonii	0.3	0.3
Sida sp. Excedentifolia (J.L. Egan 1925)	0.2	0.1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	0.1
Solanum horridum	0.1	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia brizoides	0.3	55
Triodia epactia	0.3	5

PHOTO

Site Name:	MC011
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	12/05/2012
GPS Location:	WGS84 Zone 51 198509E 7609087N
Landform Type:	Crest/ Upper slope (other)
Slope Class:	Very Steep (37 degrees)
Aspect:	N
Soil Type:	Sandy Loam
Soil Colour:	Dark brown (other)
Rock Outcrop:	Quartz (other), 10-20% bedrock exposed
CF Abundance:	>90%
CF Sizes:	6-20mm, 20-60mm, 60-200mm, 200-600mm
CF Types:	Ironstone, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia (3m, 0.7%)
Mid Stratum 2:	Low Isolated Clumps of Shrubs of Acacia ptychophylla and Indigofera monophylla (0.3m, 5%)
Lower Stratum 1:	Low Closed Hummock Grassland of Triodia brizoides and T. epactia (0.2m, 85%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.5	0.3
Acacia inaequilatera	2	0.3
Acacia ptychophylla	0.2	3
Corymbia hamersleyana	3	0.5
Cymbopogon ambiguus	0.5	0.5
Dampiera candicans	0.3	0.2
Dodonaea coriacea	0.5	0.2
Eriachne ciliata	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	2	0.2
Fimbristylis simulans	0.1	0.1
Goodenia triodiophila	0.2	0.1
Grevillea wickhamii subsp. *hispidula*	1.5	0.3
Hibiscus sturtii var. *campylochlamys*	0.2	0.1
Indigofera monophylla	0.3	2
Polycarpaea holtzei	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.5	0.1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	2	0.1
Triodia brizoides	0.2	70
Triodia epactia	0.2	15

PHOTO

Site Name:	MC012
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	08/05/2012
GPS Location:	WGS84 Zone 51 196331E 7608567N
Landform Type:	Other, Undulating plain (other)
Slope Class:	Very Gently Inclined (1 degree)
Soil Type:	Clay sand (other)
Soil Colour:	Red
Rock Outcrop:	Granite, Ironstone, Quartz (other), 20-50% bedrock exposed
CF Abundance:	<2%
CF Sizes:	6-20mm, 20-60mm, 60-200mm, 200-600mm
CF Types:	Granite, Ironstone, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	Weeds (Cenchrus ciliaris), Cattle (other)
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Mid Stratum 1:	Mid Open Shrubland of Acacia bivenosa and Acacia trachycarpa (2m, 16%)
Lower Stratum 1:	Mid Isolated Clumps of Tussock Grasses of Chrysopogon fallax (0.5m, 0.5%)
Lower Stratum 2:	Low Closed Hummock Grassland of Triodia epactia and T. wiseana (0.4m, 83%) and Low Isolated Clumps of Tussock Grasses of *Cenchrus setiger (0.3m, 1.5%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Abutilon lepidum	0.3	0.2
Abutilon macrum	0.1	0.1
Acacia bivenosa	2	15
Acacia trachycarpa	1.5	1
Alysicarpus muelleri	0.2	0.3
Aristida contorta	0.1	0.2
Carissa lanceolata	1	0.3
**Cenchrus setiger*	0.3	1.5
Chrysopogon fallax	0.5	0.5
Corchorus parviflorus	0.3	0.1
Corchorus sp.	0.1	0.1
Dactyloctenium radulans	0.1	0.1
Dichanthium sericeum subsp. *humilius*	0.1	0.1
Enneapogon lindleyanus	0.1	0.1
Enneapogon polyphyllus	0.2	0.1
Eragrostis cumingii	0.1	0.1
Eremophila forrestii subsp. *forrestii*	0.4	0.2
Euphorbia australis	0.1	0.1
Euphorbia trigonosperma	0.1	0.2
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Fimbristylis dichotoma	0.1	0.2
Gomphrena cunninghamii	0.1	0.1
Goodenia muelleriana	0.2	0.1
Gossypium australe	0.4	0.2
Heliotropium cunninghamii	0.2	0.1

Hibiscus sturtii var. *platychlamys*	0.2	0.2
Indigofera colutea	0.1	0.2
Paspalidium clementii	0.1	0.1
Perotis rara	0.1	0.1
Phyllanthus erwinii	0.1	0.1
Polygala isingii	0.1	0.1
Polymeria ambigua	0.1	0.1
Pterocaulon ?sphaeranthoides	0.2	0.1
Ptilotus auriculifolius	0.1	0.1
Rhynchosia minima	0.1	0.3
Senna artemisioides subsp. *helmsii*	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.3	0.1
Senna glutinosa subsp. *glutinosa*	1	0.2
Sida echinocarpa	0.3	0.1
Sida fibulifera	0.1	0.1
Sida sp. L (A.M. Ashby 4202)	0.2	0.1
Streptoglossa sp.	0.2	0.1
Swainsona stenodonta	0.1	0.1
Tragus australianus	0.1	0.1
Trichodesma zeylanicum var. ?*zeylanicum*	0.2	0.1
Triodia epactia	0.4	80
Triodia longiceps	0.4	0.2
Triodia wiseana	0.3	3

PHOTO

Site Name:	MC013
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	11/05/2012
GPS Location:	WGS84 Zone 51 198795E 7608936N
Landform Type:	Upper slope/ Low hill (other)
Slope Class:	Gently Inclined (3 degrees)
Aspect:	N
Soil Type:	Sandy Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	Ironstone, >50% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	4-5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Tall Isolated Clumps of Trees of Eucalyptus leucophloia subsp. leucophloia (7m, 1%)
Mid Stratum 1:	Mid Shrubland of Acacia tumida var. pilbarensis (1.5m, 70%)
Lower Stratum 1:	Low Open Hummock Grassland of Triodia epactia (0.3m, 15%)
Lower Stratum 2:	Low Isolated Clumps of Tussock Grasses of Eriachne lanata (0.3m, 2%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	1	0.2
Acacia ptychophylla	0.3	0.4
Acacia pyrifolia var. *morrisonii*	1.5	0.2
Acacia tumida var. *pilbarensis*	1.5	70
Bonamia pilbarensis	0.1	0.1
Cymbopogon ambiguus	0.4	0.1
Dampiera candicans	0.4	0.5
Eriachne lanata	0.3	2
Eriachne mucronata	0.5	0.7
Eucalyptus leucophloia subsp. *leucophloia*	7	1
Fimbristylis simulans	0.1	0.1
Gompholobium oreophilum	0.3	0.1
Goodenia stobbsiana	0.3	0.3
Grevillea wickhamii subsp. *hispidula*	0.4	0.5
Heliotropium skeleton	0.3	0.1
Heliotropium sp.	0.1	0.1
Indigofera monophylla	0.3	0.5
Isotropis atropurpurea	0.2	0.1
Ptilotus calostachyus	0.4	0.1
Senna glutinosa subsp. *glutinosa*	0.3	0.1
Senna glutinosa subsp. *pruinosa*	1	0.1
Senna symonii	0.5	0.1

Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1	0.1
Tephrosia virens	0.4	0.6
Trigastrotheca molluginea	0.1	0.1
Triodia epactia	0.3	15
Triumfetta maconochieana	0.3	0.1

PHOTO

Site Name:	MC014
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	11/05/2012
GPS Location:	WGS84 Zone 51 199001E 7609932N
Landform Type:	Lower slope and low hill (other)
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	SE
Soil Type:	Clay Loam
Soil Colour:	Red/Brown (other)
Rock Outcrop:	Ironstone, 2-10% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	4-5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Eucalyptus leucophloia subsp. leucophloia (2.5m, 0.4%)
Lower Stratum 1:	Low Hummock Grassland of Triodia brizoides and T. epactia (0.3m, 70%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.5	0.5
Acacia ptychophylla	0.3	0.3
Bonamia pilbarensis	0.1	0.1
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	2.5	0.4
Euphorbia australis	0.1	0.1
Fimbristylis dichotoma	0.1	0.3
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.3	0.3
Goodenia triodiophila	0.1	0.1
Ptilotus calostachyus	0.4	0.1
Senna glutinosa subsp. *glutinosa*	0.8	0.2
Senna glutinosa subsp. *pruinosa*	0.1	0.1
Senna symonii	0.8	0.4
Solanum horridum	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia brizoides	0.3	60
Triodia epactia	0.2	10
Triodia longiceps	0.3	1

PHOTO

Site Name:	MC015
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	11/05/2012
GPS Location:	WGS84 Zone 51 198893E 7610190N
Landform Type:	Hill-top (other)
Slope Class:	Gently Inclined (3 degrees)
Soil Type:	Loamy clay (other)
Soil Colour:	Red/brown (other)
Rock Outcrop:	Granite, <2% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm, 200-600mm, 600-2000mm
CF Types:	Granite, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Clumps of Trees of Corymbia hamersleyana, C. candida subsp. ?dipsodes and Eucalyptus leucophloia subsp. leucophloia (6m, 4%)
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Acacia orthocarpa and Grevillea wickhamii subsp. hispidula (2.5m, 3%)
Mid Stratum 2:	Mid Isolated Clumps of SHrubs of Acacia retinivea subsp. clandestina (1m, 3%)
Lower Stratum 1:	Low Isolated Clumps of Shrubs of Indigofera monophylla (0.3m, 1.5%)
Lower Stratum 2:	Low Hummock Grassland of Triodia epactia (0.3m, 65%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia orthocarpa	2.5	3
Acacia ptychophylla	0.2	0.1
Acacia retivenea subsp. *clandestina*	1	3
Bonamia pilbarensis	0.1	0.1
Corchorus parviflorus	0.1	0.1
Corymbia ferriticola	5	1.5
Corymbia hamersleyana	6	2
Cymbopogon ambiguus	0.4	0.5
Dampiera candicans	0.4	0.1
Dodonaea coriacea	0.4	0.3
Eremophila latrobei subsp. *glabra*	0.3	0.1
Eriachne ciliata	0.1	0.1
Eriachne lanata	0.3	1
Eucalyptus leucophloia subsp. *leucophloia*	4	0.5
Fimbristylis dichotoma	0.1	0.3
Goodenia stobbsiana	0.3	0.2
Goodenia triodiophila	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	2	1
Hakea lorea subsp. *lorea*	2	0.3
Hibiscus sturtii var. *campylochlamys*	0.1	0.1
Hybanthus aurantiacus	0.1	0.1

Indigofera monophylla	0.3	1.5
Polygala isingii	0.1	0.1
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.4	0.1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1.5	0.3
Triodia brizoides	0.3	0.5
Triodia epactia	0.3	65

PHOTO

Site Name:	MC016
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	11/05/2012
GPS Location:	WGS84 Zone 51 199792E 7609810N
Landform Type:	Crest/ Upper slope (other)
Slope Class:	Steep (23 degrees)
Soil Type:	Sandy Loam
Soil Colour:	Brown
Rock Outcrop:	Quartz (other), 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm, 200-600mm, 600-2000mm
CF Types:	Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Clumps of Trees of Corymbia candida subsp. ?dipsodes and Eucalyptus leucophloia subsp. leucophloia (5m, 1.4%)
Mid Stratum 1:	Low Isolated Clumps of Shrubs of Acacia ptychophylla (0.3m, 1.5%)
Lower Stratum 1:	Low Hummock Grassland of Triodia epactia and T. brizoides (0.3m, 60%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia monticola	1	0.3
Acacia ptychophylla	0.3	1.5
Bonamia pilbarensis	0.1	0.1
Corymbia ferriticola	5	1
Dampiera candicans	0.3	0.2
Dodonaea coriacea	0.4	0.3
Eriachne ciliata	0.1	0.1
Eriachne mucronata	0.2	0.1
Eucalyptus leucophloia subsp. *leucophloia*	3	0.4
Gastrolobium grandiflorum	1.5	0.5
Goodenia stobbsiana	0.3	0.1
Goodenia triodiophila	0.2	0.1
Grevillea wickhamii subsp. *hispidula*	1	0.5
Hibiscus coatesii	0.2	0.1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1.5	0.1
Triodia brizoides	0.3	10
Triodia epactia	0.3	50

PHOTO

Site Name:	MC017
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	12/05/2012
GPS Location:	WGS84 Zone 51 199928E 7609130N
Landform Type:	Mid Slope
Slope Class:	Gently Inclined (3 degrees)
Aspect:	E
Soil Type:	Clay Loam
Soil Colour:	Red/brown (other)
Rock Outcrop:	Ironstone, 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	some edges of quadrat damaged by recent drill pads (other)
Fire:	4-5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Clumps of Trees of Eucalyptus leucophloia subsp. leucophloia (4m, 2.5%)
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Grevillea wickhamii subsp. hispidula (2.5m, 2%)
Mid Stratum 2:	Mid Closed Shrubland of Acacia tumida var. pilbarensis (2m, 80%)
Lower Stratum 1:	Low Open Hummock Grassland of Triodia epactia (0.3m, 10%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.3	0.1
Acacia monticola	1.5	0.2
Acacia pyrifolia var. *morrisonii*	2.5	0.5
Acacia tumida var. *pilbarensis*	2	80
Bonamia pilbarensis	0.1	0.1
Cymbopogon ambiguus	0.3	0.3
Dampiera candicans	0.3	0.3
Eriachne lanata	0.2	0.5
Eriachne mucronata	0.2	0.5
Eucalyptus leucophloia subsp. *leucophloia*	4	2.5
Fimbristylis simulans	0.1	0.1
Gompholobium oreophilum	0.4	0.2
Goodenia stobbsiana	0.3	0.4
Grevillea wickhamii subsp. *hispidula*	2.5	2
Hybanthus aurantiacus	0.2	0.1
Indigofera monophylla	0.4	0.3
Ptilotus calostachyus	0.5	0.1
Senna glutinosa subsp. *glutinosa*	0.5	0.1
Senna symonii	0.5	0.1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	2	0.1

Tephrosia virens	0.5	0.3
Triodia epactia	0.3	10

PHOTO

Site Name:	MC018
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	12/05/2012
GPS Location:	WGS84 Zone 51 200881E 7608802N
Landform Type:	Mid Slope
Slope Class:	Steep (23 degrees)
Aspect:	NE
Soil Type:	Sandy Loam
Soil Colour:	Light brown (other)
Rock Outcrop:	Ironstone, 2-10% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm, 200-600mm, 600-2000mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Eucalyptus leucophloia subsp. leucophloia (4m, 1%)
Lower Stratum 1:	Low Closed Hummock Grassland of Triodia brizoides (0.2m, 80%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	0.3	0.2
Acacia inaequilatera	1	0.3
Acacia tumida var. *pilbarensis*	0.4	0.2
Corchorus parviflorus	0.2	0.1
Cymbopogon ambiguus		
Dodonaea coriacea	0.4	0.2
Eucalyptus leucophloia subsp. *leucophloia*	4	1
Euphorbia schultzii	0.1	0.1
Goodenia stobbsiana	0.2	0.1
Hakea lorea subsp. *lorea*	0.5	0.2
Indigofera monophylla	0.3	0.2
Senna glutinosa subsp. *glutinosa*	0.4	0.1
Senna symonii	0.3	0.3
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Tribulus suberosus	0.1	0.1
Triodia brizoides	0.2	80
Triodia epactia		

PHOTO

Site Name:	MC019
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	12/05/2012
GPS Location:	WGS84 Zone 51 200963E 7609289N
Landform Type:	Crest of a hill (other)
Slope Class:	Gently Inclined (3 degrees)
Aspect:	E
Soil Type:	Clay Loam
Soil Colour:	Red/brown (other)
Rock Outcrop:	Ironstone, <2% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Ironstone
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	SW and NW corners are disturbed by grid-lines. Plot between grid-lines (other)
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia candida subsp. ?dipsodes and C. hamersleyana (4m, 0.7%)
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Acacia inaequilatera and Grevillea wickhamii subsp. hispidula (3m, 4.5%)
Lower Stratum 1:	Low Hummock Grassland of Triodia epactia (0.3m, 70%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia inaequilatera	3	1.5
Acacia monticola	0.3	0.1
Acacia orthocarpa	3	0.3
Acacia ptychophylla	0.3	0.1
Acacia tumida var. *pilbarensis*	2	0.3
Amphipogon sericeus	0.2	0.5
Aristida contorta	0.3	0.1
Corymbia ferriticola	2	0.2
Corymbia hamersleyana	4	0.5
Dampiera candicans	0.3	0.4
Eriachne ciliata	0.1	0.1
Eriachne mucronata	0.3	0.1
Fimbristylis dichotoma	0.1	0.1
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.3	1.5
Grevillea wickhamii subsp. *hispidula*	2.5	3
Hakea lorea subsp. *lorea*	0.5	0.1
Indigofera monophylla	0.3	0.2
Polycarpaea holtzei	0.1	0.1
Ptilotus calostachyus	0.6	0.1
Senna glutinosa subsp. *glutinosa*	0.4	0.1
Senna symonii	2	0.3

Solanum horridum	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia epactia	0.3	70

PHOTO

Site Name:	MC021
Site Type:	QUADRAT
Dimensions:	25m x 100m
Survey Date:	12/05/2012
GPS Location:	WGS84 Zone 51 200972E 7610282N
Landform Type:	Drainage line, gorge-like (other)
Slope Class:	Very Gently Inclined (1 degree)
Soil Type:	Coarse sand (other)
Soil Colour:	Light-brown (other)
Rock Outcrop:	Granite, >50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm, 200-600mm, 600-2000mm, >2000mm
CF Types:	Granite
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Open Woodland of Corymbia candida subsp. ?dipsodes and Eucalyptus leucophloia subsp. leucophloia (8m, 5.5%)
Mid Stratum 1:	Tall Shrubland of Acacia tumida var. pilbarensis and Carissa lanceolata (3m, 50%)
Mid Stratum 2:	Mid Open Shrubland of Acacia monticola, A. pyrifolia var. morrisonii, Ehretia saligna var. saligna, Santalum lanceolatum and Senna glutinosa subsp. glutinosa (2m, 10%)
Lower Stratum 1:	Low Open Tussock Grassland of Cymbopogon ambiguus, Eriachne benthamii and E. mucronata (0.4m, 10%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Abutilon lepidum	1	0.1
Acacia bivenosa	2	0.5
Acacia monticola	1.5	2
Acacia ptychophylla	0.3	0.1
Acacia pyrifolia var. *morrisonii*	2	2
Acacia tumida var. *pilbarensis*	3	40
Amaranthus undulatus	0.4	0.2
Atalaya hemiglauca	1.5	0.3
Carissa lanceolata	3	10
Cassytha capillaris		0.1
Chrysopogon fallax	0.4	0.2
Cleome viscosa	0.3	0.1
Corymbia ferriticola	8	2.5
Cymbopogon ambiguus	0.4	1
Cyperus cunninghamii subsp. *cunninghamii*	0.3	0.2
Duperreya commixta	1	0.5
Ehretia saligna var. *saligna*	1.5	2.5
Eriachne benthamii	0.3	5
Eriachne mucronata	0.3	4

Eucalyptus leucophloia subsp. *leucophloia*	6	3
Euphorbia trigonosperma	0.2	0.1
Fimbristylis simulans	0.1	0.1
Flueggea virosa subsp. *melanthesoides*	2.5	0.5
Gastrolobium grandiflorum	1.5	0.2
Gomphrena cunninghamii	0.1	0.1
Gossypium robinsonii	2	0.3
Grevillea wickhamii subsp. *hispidula*	1	0.2
Hibiscus sturtii var. *campylochlamys*	0.3	0.2
Indigofera monophylla	0.3	0.1
Isotropis atropurpurea	0.3	0.1
Jasminum didymum subsp. *lineare*	1	0.1
Melhania oblongifolia	0.3	0.1
Paspalidium clementii	0.1	0.1
Paspalidium tabulatum	0.3	0.2
Phyllanthus maderaspatensis	0.2	0.1
Polycarpaea longiflora	0.1	0.1
Ptilotus incanus	0.3	0.1
Santalum lanceolatum	2	2
Senna glutinosa subsp. *glutinosa*	1	1.5
**Setaria verticillata*	0.3	0.1
Sida ?*macropoda (complex)*	0.3	0.1
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	1.5	0.1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.1
Solanum horridum	0.1	0.1
Tephrosia virens	1	0.2
Themeda triandra	0.4	0.2
Tinospora smilacina		0.1
Trichodesma zeylanicum var. ?*zeylanicum*	0.2	0.1
Triodia epactia	0.3	0.5
Triumfetta maconochieana	0.2	0.1

PHOTO

Site Name:	MC022
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 200573E 7610881N
Landform Type:	Hillock
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	SE
Soil Type:	Clay Loam
Soil Colour:	Brown
Rock Outcrop:	Granite, 10-20% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia deserticola subsp. deserticola, C. hamersleyana and Eucalyptus leucophloia subsp. leucophloia (2.5m, 0.4%)
Mid Stratum 1:	Tall Isolated Clumps of Shrubs of Acacia inaequilatera (3.5m, 4%)
Lower Stratum 1:	Low Open Shrubland of Acacia ptychophylla (0.4m, 20%)
Lower Stratum 2:	Low Closed Hummock Grassland of Triodia brizoides and T. epactia (0.4m, 75%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia eriopoda	1.2	0.1
Acacia inaequilatera	3.5	4
Acacia ptychophylla	0.4	20
Corymbia deserticola subsp. *deserticola*	2.5	0.1
Corymbia hamersleyana	1.2	0.1
Dampiera candicans	0.5	0.1
Dodonaea coriacea	0.9	0.1
Eriachne ciliata	0.1	0.1
Eriachne mucronata	0.3	0.1
Eucalyptus leucophloia subsp. *leucophloia*	2.2	0.2
Fimbristylis dichotoma	0.2	0.1
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.2	0.1
Goodenia triodiophila	0.4	0.1
Indigofera monophylla	0.3	0.1
Polycarpaea holtzei	0.1	0.1
Polygala isingii	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.7	0.1
Senna symonii	0.6	0.1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.1
Triodia brizoides	0.4	55
Triodia epactia	0.3	20

PHOTO

Site Name:	MC023
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 200580E 7611238N
Landform Type:	Upper Slope
Slope Class:	Steep (23 degrees)
Aspect:	E
Soil Type:	Sandy Loam
Soil Colour:	Brown
Rock Outcrop:	Granite, 20-50% bedrock exposed
CF Abundance:	>90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	3 - 4 years

DOMINANT TAXA IN VEGETATION STRATA

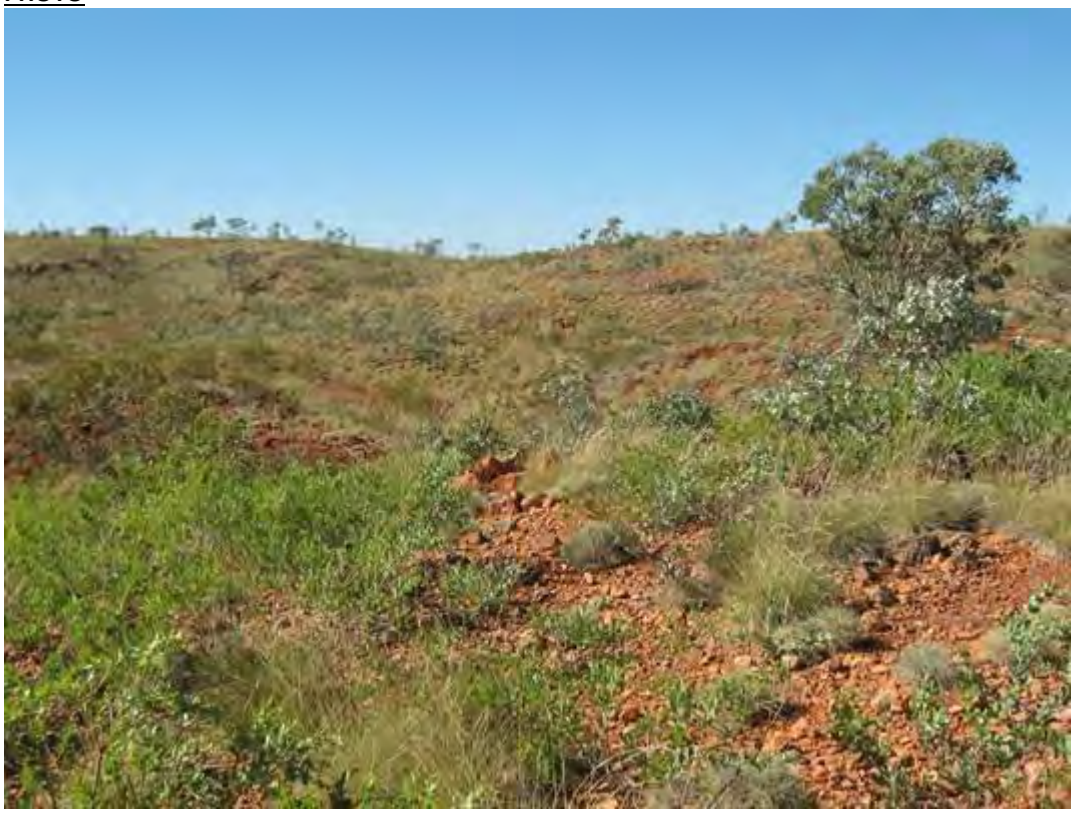
Upper Stratum 1:	Low Isolated Clumps of Trees of Eucalyptus leucophloia subsp. leucophloia (6m, 5%)
Mid Stratum 1:	Mid Sparse Shrubland of Acacia bivenosa (1m, 7%)
Lower Stratum 1:	Low Isolated Clumps of Shrubs of Acacia ptychophylla (0.4m, 2%)
Lower Stratum 2:	Low Open Hummock Grassland of Triodia epactia and T. brizoides (0.4m, 30%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	1	7
Acacia eriopoda	1.8	0.3
Acacia inaequilatera	1.3	0.1
Acacia monticola	1.5	0.1
Acacia ptychophylla	0.4	2
Acacia retivenea subsp. *clandestina*	1	0.1
Amaranthus undulatus	0.1	0.1
Aristida contorta	0.2	0.1
Bonamia pilbarensis	0.1	0.1
Bulbostylis barbata	0.1	0.1
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.1
Corchorus parviflorus	0.3	0.1
Cymbopogon ambiguus	1	0.1
Dampiera candicans	0.6	0.1
Dodonaea coriacea	0.8	0.1
Eriachne ciliata	0.1	0.1
Eriachne lanata	0.3	1
Eriachne mucronata	0.3	0.1
Eucalyptus leucophloia subsp. *leucophloia*	6	5
Euphorbia boophthona	0.1	0.1
Fimbristylis dichotoma	0.1	0.1
Gomphrena cunninghamii	0.1	0.1

Goodenia microptera	0.2	0.1
Goodenia stobbsiana	0.4	0.1
Goodenia triodiophila	0.3	0.1
Grevillea wickhamii subsp. *hispidula*	1.2	0.1
Heliotropium inexplicitum	0.1	0.1
Hibiscus coatesii	0.5	0.1
Hibiscus sturtii var. *campylochlamys*	0.2	0.1
Indigofera monophylla	0.4	0.1
Polycarpaea holtzei	0.1	0.1
Ptilotus calostachyus	0.5	0.1
Ptilotus incanus	0.1	0.1
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	1.3	0.1
Senna symonii	1.4	0.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.2	0.1
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.3	0.1
Solanum horridum	0.2	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Trigastrotheca molluginea	0.1	0.1
Triodia brizoides	0.4	15
Triodia epactia	0.4	15
Triumfetta maconochieana	0.3	0.1

PHOTO



Site Name:	MC024
Site Type:	QUADRAT
Dimensions:	50m x 50m
Survey Date:	25/05/2012
GPS Location:	WGS84 Zone 51 200051E 7611338N
Landform Type:	Upper Slope
Slope Class:	Moderately Inclined (10 degrees)
Aspect:	NW
Soil Type:	Clay Loam
Soil Colour:	Red/brown (other)
Rock Outcrop:	Granite, 10-20% bedrock exposed
CF Abundance:	50-90%
CF Sizes:	2-6mm, 6-20mm, 20-60mm, 60-200mm
CF Types:	Granite, Quartz (other)
Vegetation Condition:	Northern Vegetation Condition - E - Excellent
Disturbance:	None
Fire:	> 5 years

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1:	Low Isolated Trees of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia (5.5m, 0.6%)
Lower Stratum 1:	Low Open Shrubland of Acacia ptychophylla (0.4m, 25%)
Lower Stratum 2:	Low Closed Hummock Grassland of Triodia epactia and T. brizoides (0.4m, 75%)

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
Acacia bivenosa	1	0.2
Acacia eriopoda	1.2	0.7
Acacia ptychophylla	0.4	25
Aristida contorta	0.2	0.1
Bonamia pilbarensis	0.1	0.1
Bulbostylis barbata	0.1	0.1
Corymbia hamersleyana	5.5	0.5
Dampiera candicans	0.5	0.1
Dodonaea coriacea	1.1	0.1
Dysphania rhadinostachya subsp. *rhadinostachya*	0.2	0.1
Eriachne ciliata	0.1	0.1
Eriachne mucronata	0.3	0.1
Eucalyptus leucophloia subsp. *leucophloia*	2.2	0.1
Fimbristylis dichotoma	0.1	0.1
Goodenia stobbsiana	0.3	0.1
Goodenia triodiophila	0.2	0.1
Hakea chordophylla	3	0.1
Indigofera monophylla	0.5	0.5
Paspalidium clementii	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Polygala isingii	0.1	0.1
Ptilotus calostachyus	0.9	0.1

Senna glutinosa subsp. *glutinosa*	1.2	0.5
Senna symonii	0.9	0.1
Sida rohlenae subsp. *rohlenae*	0.4	0.1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.1
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.1
Triodia brizoides	0.4	15
Triodia epactia	0.4	60
Yakirra australiensis	0.1	0.1

PHOTO